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ANXIETY IN CHILDREN AND SOCIAL STATUS

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There have been several studies (e.g., 1, 2, 3, 6, 7, 8, 9, 15, 16, 21) since 1937 dealing with the connection between adjustment and sociometric status in child populations. All have provided at least some support for the hypothesis of a moderate positive relationship between the two ("better adjusted" children are more popular), although Northway and Wigdor (16) find some evidence of a curvilinear relationship. A recent review of sociometric validity (14) summarized a number of studies of adults that also lend support to this hypothesis.

In the child field, the hypothesis has been most recently (and perhaps most rigorously) supported by Thorpe's (19) research with British school children. He studied 980 children in 34 classes, mean chronological age 12-8 years, using a scale that has been shown to possess some validity which he adopted from Eysenck. This test includes seven different "scales" which, grouped, are used to define "neuroticism." Thorpe obtained a pooled r of —.152, standard error .034, between "neuroticism" and sociometric status.

In the other child studies mentioned above, the adjustment measure has generally been a global inventory such as the California Test of Personality (7) or the Mental Health Analysis, Elementary or Intermediate Series, Form A (1, 6). Rorschachs have also been used (16), as well as

[1] The authors wish to express appreciation to Mr. Buford Garner, Superintendent; Mr. David Stewart, Coordinator of Elementary Curriculum; and Mrs. Sylvella Jacobsen, Psychologist, all of the Iowa City Public Schools; and the 15 Iowa City classroom teachers who administered tests, as well as the four elementary school principals concerned, for their help in making this study possible.

teachers' or observers' ratings, interviews, case histories (2, 3, 8, 15) and problem check lists (9).

Previous studies by the present authors have reported the form, scoring, norms and reliabilities (4) for the children's form of the manifest anxiety scale (CMAS), as well as data concerning relationships of the scale with performance in complex learning situations (5, 17) and in the area of academic achievement (12). The literature demonstrating predictive power for Taylor's adult form of the manifest anxiety scale (18) is voluminous. The authors have also been interested for some time in sociometric techniques from the points of view both of their reliability and usefulness (10, 11).

TABLE 1

TEST-RETEST RELIABILITIES (ONE-WEEK INTERVAL, PRODUCT-MOMENT) FOR RATE AND RANK METHODS OF ASSESSING SOCIOMETRIC STATUS, BY GRADE GROUPS AND BY SEX

	CLASS									
	1		2		3		4		5	
Grade, Sex	*N*	*r*	*N*	*r*	*N*	*r*	*N*	*r*	*N*	*r*
4 B	8(r)	.93**	15(r)	.75**	9	.77*	10	.92**	15	.99**
4 G	11(r)	.98**	10(r)	.70*	15	.90**	15	.92**	10	.97**
5 B	10	.93**	17	.95**	11	.95**	16(r)	.96**	16(r)	.55*
5 G	12	.80**	16	.96**	13	.96**	7(r)	.91**	16(r)	.96**
6 B	11	.95**	18	.90**	13(r)	.94**	7(r)	.91**	18	.94**
6 G	5	.91*	12	.98**	10(r)	.94**	11(r)	.82**	12	.96**

NOTE.—An (r) preceding a coefficient indicates that it was obtained by the rate method.
* Significant at less than the .05 level.
** Significant at less than the .01 level.

SOCIOMETRIC PROCEDURES AND RESULTS

Two teacher-administered sociometric techniques were administered, the rank method to nine classes, the rate method to six classes of public school fourth, fifth and sixth grade children. These were repeated, same methods for same classes, one week later to determine test-retest reliability. The population taking both tests numbered 369 children, 194 boys and 175 girls. The sociometric was a one-question "friend" instrument. This choice of a one-question, rank and rate sociometric was due to the authors' quest for a very simple instrument which could be administered by teachers from prepared instruction and data sheets.

The rank method was administered (by sexes rather than whole classes) in this fashion: a mimeographed list of all girls in a class was distributed to each girl, a list of all boys to each boy in a class. Children were instructed

to enter a (1) after the name of their very best friend, a (2) after the name of their second best friend, and so on until every child but the one doing the ranking had a different number after his name, the largest number (n) being the number of boys or girls in a class, excepting the child doing the ranking.

The rate method was also given by sex. A sheet similar to the rank sheet was handed to each boy or girl, with the names of all the boys or girls in a class in a column down the left hand side of the page. A line to the right of each name included five equidistant check points, each subsumed by a number from (1) to (5) reading from left to right. The child

TABLE 2

POOLED PRODUCT-MOMENT CORRELATIONS BY GRADE AND SEX BETWEEN CMAS SCORES AND SOCIOMETRIC STATUS

Grade, Sex	*N Classes*	*N Individuals*	*r*
4 B	5	58	—.28*
4 G	5	62	—.23
5 B	5	72	—.51**
5 G	5	69	—.75**,†
6 B	5	73	—.16
6 G	5	53	.01

* Significant at less than the .05 level.

** Significant at less than the .01 level.

† This is an estimate based on five fifth grade classes, the correlation population of which proved to be nonhomogeneous at just below the .05 level (all other class populations were homogeneous). The correlations and N's for the five classes were: 1. $r = -.90$, $N = 14$; 2. $r = -.55$, $N = 17$; 3. $r = -.46$, $N = 15$; 4. $r = +.03$, $N = 7$; 5. $r = -.81$, $N = 16$.

was instructed to check a point for each name other than his own, a (1) if the child was a "best friend," a (3) if he didn't know the child very well or neither liked nor disliked him, and a (5) if the child "is not my friend," etc.

Table 1 gives reliability figures (product moment r's) by class, grade and sex for the two methods of sociometric assessment. The scores on which these correlations are based are the average rating or the average ranking received by a child. This score was the average of all ranks or ratings given by other children of his own sex to a given child. Consequently the lowest score represents the most popular child for a sex-class group. However, for clearness of presentation, signs of correlation coefficients in Table 2 above have been changed so that a negative correlation means that there is a tendency for the more anxious children to be less popular, and vice versa.

There is no clearcut reliability difference between the rate and the rank methods; of the four reliabilities below .80, three were obtained by use of the rate method, two of these three being for fourth grade groups; and of the 12 reliabilities of .95 or more, only three were obtained by the rate method. Only four of the 30 reliabilities computed fail to reach significance at less than the .01 level. Two of these were obtained by the rank, two by the rate method, and all four were significant at less than the .05 level. Median test-retest reliability for the rate method (12 measures for six classes) was .92; and for the rank method (18 measures for nine classes) was .95. However, correlation range for the rate method (.55–.98) was greater than for the rank method (.77–.99).

At a more general level, this study indicates that a single question, teacher-administered-by-group sociometric, sexes separated, results in high reliabilities as judged by test-retest at a one-week interval. The reliabilities compare favorably with the studies reviewed by either Mouton, Blake and Fruchter (13) or by Witryol and Thompson (20).

Anxiety Scale Procedures and Results

The hypothesis for this section of the study was that there would be a negative relationship between anxiety and social acceptability in fourth, fifth and sixth grade public school children (i.e., that more anxious children would be less popular). Subjects were 387 fourth, fifth and sixth graders from the public schools of a midwestern town of about 27,000 population. There were 203 boys and 184 girls. The population completely overlaps the sociometric population described above, differences in N being due to absences on retests for the sociometric. All relationships reported here are between a first administration of the CMAS and the sociometric assessment. Rank and rate methods of collecting sociometric data are combined in this portion of the study, since there were no significant differences in their relationship with CMAS scores between the two methods.

Table 2 shows correlations by grade and sex of the CMAS scores and sociometric status. The CMAS, as was also true of the sociometric assessments, was administered by classroom teachers. It was also repeated a week later to provide the reliability data reported in (4).

The over-all picture from Table 2 supports the hypothesis of a negative relationship between anxiety and social status (more anxious children are less popular) although there is clear variation by grades. The reasonably substantial N's, both of classes and individuals, the relative consistency by sexes in a grade (see below) and the frequency of significant correlations all argue against the notion of random variation as an explanation of this correlation pattern. Fourth graders, boys and girls, have low negative r's (for fourth grade boys r is significant at less than the .05 level, and r for fourth

grade girls misses the .05 significance level by only .02). Correlations for both fifth grade boys and girls are significant at less than the .001 level, while sixth graders' *r*'s hover close to zero. A social class differential cannot be argued, since the fourth, fifth and sixth graders are drawn by groups, each group coming from the same school. One can only suspect different social interaction patterns which are a function of unknown factors, possibly of grade and age (including physical maturity), teacher influence, or other, and look further for reasons for the variability.

As a check on within-class similarity (for which teachers might possibly be thought to be most responsible) an analysis of variance was run to test the relationship of within-groups variance (within a given class) to between groups variance (all grades and classes). Utilizing the 15 classes, including the one fifth grade class of girls (class 1, footnote, Table 2) that contributed most heavily to nonhomogeneity, the resulting F was 1.80, which is nonsignificant for 14 and 15 *d.f.* ($F = 2.43$ is required for .05 level of significance). Eliminating this class, F equalled 3.60, which is significant for 13 and 14 *d.f.* at between the .01 and .02 levels. This analysis suggests very tentatively that there is a tendency for a given class, regardless of sex, to follow a given pattern of anxiety-social status relationship. The over-all nonhomogeneity of the correlations in Table 2 lends further support to this idea.

However, this over-all nonhomogeneity (the null hypothesis of no difference in the total correlation population is rejected at less than the .01 level) is due most heavily to the single class of fifth grade girls mentioned above. Dropping this single half-class enables us to retain the null hypothesis at between the .20 and .10 levels, and results in an average correlation between anxiety and social acceptance of —.32, significant at less than the .001 level. Average *r*'s for boys and girls respectively (dropping the single deviant class of fifth grade girls) are —.33 and —.30, both significant at less than the .01 level.

Summary and Conclusions

High reliabilities, using the test-retest method at a one-week interval, were obtained for single-question friendship sociometrics administered by classroom teachers. The rank and rate methods were administered to fourth, fifth and sixth grade populations, the sexes separated, to obtain these reliabilities. There is a suggestion that the rank method is slightly more reliable, although differences in reliabilities between the two methods are slight.

Relationships between scores obtained by using the children's form of the manifest anxiety scale, and sociometric status, were predominantly negative (i.e., the more anxious youngsters were the less popular) for both

boys and girls. These relationships were high for fifth graders, moderate for fourth graders and approximately zero for sixth graders. There is some indication that there may be characteristic "class climates" not dependent upon differences between the sexes. This, at a speculative level, may possibly be said to be related to the influence of the teacher on the class. An over-all lack of homogeneity of the correlation population supports the notion of "class climate," although when one half class of deviant fifth grade girls is dropped, the correlation population shows homogeneity. The resulting average correlation between anxiety and sociometric standing is then —.32, statistically significant. The authors believe, however, that looking at the correlations by grade and sex provides a more meaningful way of regarding the data than does concentration on the average *r*.

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SOME EMOTIONAL ATTITUDES OF THE YOUNG CHILD IN RELATION TO CHARACTERISTICS OF HIS SIBLING[1,2]

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The study is part of a more extensive one dealing with the question of the relation between personality characteristics of the five- and six-year-old from two-child families and his ordinal position, the sex of his sibling, and the age difference which separates him from his sibling. The dependent variables to be related here to the independent variables named above are teachers' ratings of the children on the following traits: excitability, intensity of emotional response, speed of recovery from emotional disturbance, stability of mood, nervous habits, physical activeness, health, apprehensiveness relative to physical activities, social apprehensiveness, sensitiveness, tendency to anger readily, self-confidence, finality of decision or degree of vacillation, cheerfulness, tendency to alibi, tendency to project blame, and indirectness of response to fear and frustration.

The subjects were 384 five- and six-year-olds from two-child, urban, white, native-born, intact families. Both sibs were "normal" physically and mentally; i.e., a child with any serious defect or with a sib who so suffered

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[2] The author wishes to acknowledge the help received from, and to express her gratitude to, the teachers and principals of the following schools in Chicago which participated in the study: Bennett School, Bradwell School, Field School, Holmes School, Gunsalus School, Luella School, Perry School, Schmid School, Sullivan School, Wentworth School, University of Chicago Laboratory Schools, and the University of Chicago Nursery School. The author is also much indebted to Dr. Grace Munson and Dr. Thelma Thurstone, both formerly Directors of the Bureau of Child Study, Chicago Public Schools. Dr. Helen Heath did most of the statistical work for the study. We acknowledge with gratitude her discriminating and loyal service.

was eliminated from the study. No foster children were included and, as far as the school knew, the family was intact. If, in the interview we had with the child, we discovered we had reason to suspect the family members might not be living together, we dropped the child as a subject.

The children were grouped into 24 matched subgroups of 16 each. The design involved child subjects of two sexes, siblings of two sexes, two ordinal positions, and three age-difference levels. There were 48 children in each of the following groups: male with a male sib older, male with a male sib younger, male with a female sib older, male with a female sib younger, female with a male sib older, female with a male sib younger, female with a female sib older, female with a female sib younger. Each of the groups of 48 were divided into three subgroups of 16 each; the children in the three subgroups differing in age from their sib by (1) less than two years, (2) two to four years, and (3) four to six years, respectively. The children were drawn chiefly from the public schools of Chicago, only one private school system, the University of Chicago Laboratory Schools, contributing subjects.

The matching was done individual by individual on the basis of age, and the socio-economic status of the child's father's occupation (5), as well as the neighborhood of residence of the child's family (13). Matching, of course, could not be exact but 98 per cent of the matchings in age were within six months; 93 per cent, within one level on the occupational scale; and 88 per cent, within one level on the neighborhood scale. Level 4 on the Minnesota occupation scale (5) was omitted because the children were all urban residents. The group compositions have been described in detail in an earlier publication in this journal (9).

We have no direct reliability measure of the ratings but, although our measures are not the same and the populations very different, the general level of the reliabilities may perhaps be estimated *roughly* from those presented in References (2) and (14). There is, of course, a question of the extent to which our measures are fogged by halo effects and the teachers' inability to discriminate differences between children and between traits. The teachers had worked with most of the children they rated from five to nine months, three months being the lower limit of duration of contact permitted. The ratings were, of course, based chiefly on school behavior and were apparently conscientiously made. Since relatively more of our subjects in the more difficult-to-locate family constellation patterns came from two very large schools, it is possible a school standard factor may be blurring results some. We suspect this effect is not considerable, as the teachers were given in each rating scale a rather careful definition of each trait, and most of the teachers had taught in a number of schools. Hence their standards of child behavior were not based solely on their contact with the children of one school. The matching of groups on a socio-economic basis probably further diluted the effect of a school-standard variable, if one were

operative. The individual judge variable was probably fairly well controlled, too, because there were many raters and their ratings were well scattered through the groups. Most teachers rated only a few cases. There are other possible selective effects in our data. For a discussion of some of these see References (8) and (9).

The rating scales used were drawn from the Fels Child Behavior Rating Scales (14) and the California Behavior Inventory for Nursery School Children (1). The Fels scales are indicated by a star next to the caption in the tables of means, the unstarred scales, then, being the California ones. All scales were treated as line scales. The teachers' line checkings were converted into ratings on a nine-point scale with the help of a grid and these ratings were then normalized on the basis of a population of 498 five- and six-year-olds, of which our groups constituted the major part.

The Bartlett test (3, pp. 195-200) was applied to determine whether there was any evidence the subgroups might be drawn from populations with different variances. There was no evidence they were.

The analysis of variance data for the total population only are offered in Table 10; and, if a trait showed no significant relation to any of our independent variables, no variance data at all are presented. The traits of which the latter was true are: intensity of emotional response, physical apprehensiveness, moodiness, emotional excitability, and tendency to project blame. *F*'s are given in Table 10 only if the group difference is significant at the 5 per cent point or better. To determine significance of the differences between various subgroups, *t*'s were computed when indicated but are not offered here in the interest of economy. Unless specified, the differences labelled significant in the text are so at the 5 per cent point at least.

The reader is referred to References (1) and (14) for the definitions of the various traits studied. In the main, the definitions are traditional and need not be reproduced here. The "health" scale we are somewhat uneasy about because our teachers probably were not well qualified to make a judgment on this trait. Their impression of a child's health was doubtless influenced by the latter's attendance record (which, of course, may be as much a function of the parents' attitudes as of the child's health), the parents' comments on the child, as well as the appearance and behavior of the child himself. The health ratings, hence, will be difficult to interpret. Moreover, whether we can assume to be constant from group to group any error there is, is also a question. We suspect, for instance, parents' attitudes toward health and school attendance may be a function in part of the variables studied. It seems not too unlikely that parents would be more protective of their first-born than later children or more rigidly insistent on regular attendance for him; or that one sex would be kept out of school more than the other. We thought for a while we would employ school attendance records in the place of health ratings, but the

former were found completely unusable, being subject to all the hazards of the ratings employed, as well as those stemming, among other things, from arbitrary school regulations relative to when the child was or was not on the school rolls.

The definition of sensitiveness in the Fels Scale we suspect would cause the rating on this trait to be strongly influenced by an alertness characteristic in the child as well as by signs that the child's feelings were easily hurt. This two-dimensional characteristic of the defined trait may make the interpretations of the ratings difficult. A fairly confident child may be very alert to the relevance of situations for his status, for instance, without being particularly easily hurt. How the two vectors combine in the ratings is not very clear. There is evidence some of the Fels judges were unable to agree well on this trait (14).

The nervous habits listed in our definition of these include such items as thumb-sucking, nail biting, blinking, and grimacing. The magnitude of the rating is a function of both the number of different types of habits exhibited as well as of the frequency of occurrence of any type. Just what these behavior patterns mean in the individual's adjustments is not too clear. The list does not include any visceral activities which actually may be more diagnostic of tension than the items mentioned. The overt patterns may be highly correlated with energy level or with activeness denied more constructive outlets in the classroom. Local irritants instigating the automatisms may also vary from group to group, being, for instance, possibly greater for boys than for girls who are less active and are bruised less. Schoolroom atmosphere may be another variable influencing the number and frequency of occurrence of the nervous habits shown, but, since many classes contributed to the populations of our various subgroups, classroom atmosphere is probably no important determinant of our group differences. Let us add the comment that Conrad's judges did not agree well in their ratings of the trait, nervous habits (2).

Since the relations to be described are complicated, we shall use the outline form in characterizing them, first describing relations in terms of our various independent variables. Later we shall offer a summary characterization of the various sib's-sex and ordinal-position groups. Also, since many interactions are significant, the same relation will be listed under two or three headings, though, in each, its description may be given a different emphasis.

To save space we shall often refer to the groups in code. The first letter and number in the code will indicate the sex and ordinal position of the children in the group; the second letter, the sex of their siblings; and the numbers in parentheses, the range of the difference in age (in months) between the child subjects and their sibs. Thus M1F(25-48) refers to the group of first-born boys each of whom has one sib, a sister younger by 25 to 48 months.

TABLE 1

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: EMOTIONAL EXCITABILITY* AND INTENSITY OF EMOTIONAL RESPONSE*

Subgroup			Emotional Excitability*				Intensity of Emotional Response*			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	4.209	4.181	3.859	4.083	3.922	3.938	4.170	4.010
M	2	F	4.188	3.642	4.211	4.014	3.867	3.738	4.111	3.905
F	2	M	4.086	4.102	3.919	4.036	3.900	3.972	3.951	3.941
F	2	F	4.044	3.982	4.157	4.061	4.012	3.886	4.164	4.021
M	1	M	3.767	4.100	3.769	3.879	3.734	4.409	4.191	4.111
M	1	F	3.898	4.469	4.043	4.137	3.559	4.363	3.963	3.962
F	1	M	4.005	3.960	3.985	3.983	4.285	4.023	3.917	4.075
F	1	F	3.792	4.099	4.216	4.036	3.788	4.187	4.434	4.137
M	2	M or F	4.199	3.912	4.035	4.049	3.894	3.838	4.140	3.958
F	2	M or F	4.065	4.042	4.038	4.048	3.956	3.929	4.058	3.981
M	1	M or F	3.832	4.285	3.906	4.008	3.646	4.386	4.077	4.036
F	1	M or F	3.898	4.030	4.101	4.010	4.037	4.105	4.176	4.106
M or F	2	M	4.148	4.142	3.889	4.059	3.911	3.955	4.061	3.975
M or F	2	F	4.116	3.813	4.184	4.038	3.939	3.812	4.138	3.963
M or F	1	M	3.886	4.030	3.877	3.931	4.009	4.216	4.054	4.093
M or F	1	F	3.845	4.284	4.129	4.086	3.673	4.275	4.198	4.049
M	1 or 2	M	3.988	4.141	3.814	3.981	3.828	4.173	4.181	4.061
M	1 or 2	F	4.043	4.056	4.127	4.075	3.713	4.051	4.037	3.933
F	1 or 2	M	4.045	4.031	3.952	4.010	4.093	3.998	3.934	3.008
F	1 or 2	F	3.918	4.041	4.187	4.048	3.900	4.036	4.299	4.079
M	1 or 2	M or F	4.016	4.098	3.971	4.028	3.770	4.112	4.109	3.997
F	1 or 2	M or F	3.982	4.036	4.069	4.029	3.996	4.017	4.117	4.043
M or F	1 or 2	M	4.017	4.086	3.883	3.995	3.960	4.085	4.057	4.034
M or F	1 or 2	F	3.980	4.048	4.157	4.062	3.805	4.044	4.168	4.006
M or F	2	M or F	4.132	3.977	4.037	4.048	3.925	3.883	4.099	3.969
M or F	1	M or F	3.865	4.157	4.003	4.009	3.841	4.246	4.126	4.071
M or F	1 or 2	M or F	3.999	4.067	4.020	4.029	3.883	4.064	4.113	4.020

Ordinal-Position-Group Differences

1. Second-borns were rated significantly higher in speed and degree of recovery from emotional upsets than were first-borns only when the sib spacing was under two years (Tables 2, 10).

2. The younger sib among males was judged to have more nervous habits or to indulge in them more frequently than the older sib, while the opposite trend relative to ordinal position obtained for females (Tables 8, 10).

3. The health estimates for first-borns from opposite-sex sib pairs tended to be better than those for second-borns from parallel groups;

TABLE 2

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: SPEED OF RECOVERY FROM EMOTIONAL DISTURBANCE AND MOODINESS

Subgroup			Speed of Recovery from Emotional Disturbance				Moodiness			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	3.940	3.958	4.311	4.070	4.081	4.089	3.958	4.043
M	2	F	4.211	4.298	3.824	4.111	4.159	3.911	4.124	4.065
F	2	M	4.468	4.130	3.695	4.098	4.111	3.848	3.828	3.929
F	2	F	4.023	3.868	3.966	3.952	3.896	4.079	3.553	3.843
M	1	M	4.188	3.495	4.009	3.897	3.993	4.552	3.768	4.104
M	1	F	3.653	4.016	4.099	3.923	4.116	4.386	4.175	4.226
F	1	M	3.318	4.061	4.201	3.860	4.108	3.839	4.271	4.073
F	1	F	3.880	3.774	4.191	3.948	4.417	4.104	3.869	4.130
M	2	M or F	4.076	4.128	4.068	4.090	4.120	4.000	4.041	4.054
F	2	M or F	4.245	3.999	3.830	4.025	4.004	3.963	3.690	3.886
M	1	M or F	3.920	3.755	4.054	3.910	4.054	4.469	3.972	4.165
F	1	M or F	3.599	3.917	4.196	3.904	4.263	3.971	4.070	4.101
M or F	2	M	4.204	4.044	4.003	4.084	4.096	3.968	3.893	3.986
M or F	2	F	4.117	4.083	3.895	4.032	4.028	3.995	3.839	3.954
M or F	1	M	3.753	3.778	4.105	3.879	4.050	4.195	4.020	4.088
M or F	1	F	3.767	3.895	4.145	3.935	4.267	4.245	4.022	4.178
M	1 or 2	M	4.064	3.727	4.160	3.984	4.037	4.320	3.863	4.073
M	1 or 2	F	3.932	4.157	3.961	4.017	4.138	4.149	4.150	4.145
F	1 or 2	M	3.893	4.095	3.948	3.979	4.110	3.843	4.049	4.001
F	1 or 2	F	3.952	3.821	4.078	3.950	4.157	4.091	3.711	3.986
M	1 or 2	M or F	3.998	3.942	4.061	4.000	4.087	4.234	4.006	4.109
F	1 or 2	M or F	3.922	3.958	4.013	3.965	4.133	3.967	3.880	3.994
M or F	1 or 2	M	3.978	3.911	4.054	3.981	4.073	4.082	3.956	4.037
M or F	1 or 2	F	3.942	3.989	4.020	3.984	4.147	4.120	3.930	4.066
M or F	2	M or F	4.161	4.063	3.949	4.058	4.062	3.981	3.866	3.970
M or F	1	M or F	3.760	3.836	4.125	3.907	4.158	4.220	4.021	4.133
M or F	1 or 2	M or F	3.960	3.950	4.037	3.982	4.110	4.101	3.943	4.052

while, in the case of those children from same-sex sib pairs, the ordinal-position trend was reversed (Tables 9, 10).

4. Second-born males at the closest spacing earned a higher mean rating in the trait, tendency to anger, than did first-born males; but at the middle spacing first-born males rated higher than did second-born. The trend among females was for first-borns to exceed second-borns, the difference being significant, however, only at the widest spacing (Tables 4, 10).

5. Those children who were the older in their sib pairs tended to receive a higher rating in self-confidence than did those who were the younger member (Tables 5, 10).

TABLE 3

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: SOCIAL APPREHENSIVENESS* AND PHYSICAL APPREHENSIVENESS*

Subgroup			Social Apprehensiveness*				Physical Apprehensiveness*			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	4.424	4.154	3.697	4.092	3.946	3.924	3.766	3.879
M	2	F	4.346	3.974	4.091	4.137	3.832	4.006	4.074	3.971
F	2	M	4.091	3.802	4.067	3.987	3.928	3.671	4.098	3.899
F	2	F	3.849	4.306	4.014	4.056	3.558	4.079	4.040	3.892
M	1	M	4.148	4.143	3.765	4.019	4.485	3.759	4.317	4.187
M	1	F	4.328	3.812	4.066	4.069	3.971	3.677	4.285	3.978
F	1	M	3.814	3.793	3.450	3.685	3.823	4.047	3.901	3.923
F	1	F	3.983	4.103	4.013	4.033	4.175	3.929	3.988	4.031
M	2	M or F	4.385	4.064	3.894	4.115	3.889	3.965	3.920	3.925
F	2	M or F	3.970	4.054	4.040	4.021	3.743	3.875	4.069	3.896
M	1	M or F	4.238	3.977	3.916	4.044	4.228	3.718	4.301	4.082
F	1	M or F	3.898	3.948	3.732	3.859	3.999	3.988	3.944	3.977
M or F	2	M	4.258	3.978	3.882	4.039	3.937	3.798	3.932	3.889
M or F	2	F	4.098	4.140	4.053	4.097	3.695	4.043	4.057	3.932
M or F	1	M	3.981	3.968	3.608	3.852	4.154	3.903	4.109	4.055
M or F	1	F	4.155	3.957	4.040	4.051	4.073	3.803	4.137	4.004
M	1 or 2	M	4.286	4.148	3.731	4.055	4.215	3.842	4.042	4.033
M	1 or 2	F	4.337	3.893	4.079	4.103	3.902	3.841	4.180	3.974
F	1 or 2	M	3.952	3.797	3.758	3.836	3.875	3.859	3.999	3.911
F	1 or 2	F	3.916	4.204	4.013	4.045	3.866	4.004	4.014	3.962
M	1 or 2	M or F	4.312	4.021	3.905	4.079	4.058	3.841	4.111	4.004
F	1 or 2	M or F	3.934	4.001	3.886	3.940	3.871	3.932	4.007	3.936
M or F	1 or 2	M	4.119	3.973	3.745	3.946	4.045	3.850	4.020	3.972
M or F	1 or 2	F	4.127	4.049	4.046	4.074	3.884	3.923	4.097	3.968
M or F	2	M or F	4.178	4.059	3.967	4.069	3.816	3.920	3.995	3.910
M or F	1	M or F	4.068	3.962	3.824	3.952	4.113	3.853	4.123	4.030
M or F	1 or 2	M or F	4.123	4.011	3.895	4.010	3.965	3.887	4.059	3.970

6. Girls with a younger sister were judged more vacillating than girls with an older sister when the children differed from their sibs by over four years in age or by less than two (Tables 5, 10).

7. First-borns at the two-to-four-year sib-age-difference level were judged to alibi more than second-borns (Tables 6, 10).

8. First-born boys at the middle spacing received a higher mean rating in tendency to respond indirectly to fear and frustration than did second-born; whereas, at the same spacing, girls with an older sister scored higher than did girls with a younger (Tables 7, 10).

TABLE 4

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: CHEERFULNESS* AND TENDENCY TO ANGER

Subgroup			Cheerfulness*				Tendency to Anger			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	3.609	3.971	4.090	3.890	4.582	3.959	4.291	4.277
M	2	F	3.898	4.198	4.292	4.129	4.191	3.938	4.327	4.152
F	2	M	4.388	4.133	3.913	4.144	4.015	3.704	3.694	3.804
F	2	F	4.184	3.784	4.113	4.027	3.765	3.849	3.763	3.792
M	1	M	3.970	3.426	4.072	3.823	3.758	4.413	4.022	4.064
M	1	F	3.978	3.922	4.006	3.969	3.836	4.603	4.241	4.227
F	1	M	3.871	4.095	3.984	3.984	4.263	3.899	4.239	4.134
F	1	F	3.981	3.550	3.839	3.790	3.767	4.037	4.198	4.000
M	2	M or F	3.753	4.084	4.191	4.010	4.386	3.948	4.309	4.215
F	2	M or F	4.286	3.958	4.013	4.086	3.890	3.777	3.728	3.798
M	1	M or F	3.974	3.674	4.039	3.896	3.797	4.508	4.132	4.145
F	1	M or F	3.926	3.823	3.912	3.887	4.015	3.968	4.218	4.067
M or F	2	M	3.999	4.052	4.001	4.017	4.298	3.831	3.993	4.041
M or F	2	F	4.041	3.991	4.202	4.078	3.978	3.894	4.045	3.972
M or F	1	M	3.921	3.761	4.028	3.903	4.010	4.156	4.131	4.099
M or F	1	F	3.980	3.736	3.923	3.880	3.802	4.320	4.219	4.114
M	1 or 2	M	3.790	3.698	4.081	3.856	4.170	4.186	4.156	4.171
M	1 or 2	F	3.938	4.060	4.149	4.049	4.013	4.270	4.284	4.189
F	1 or 2	M	4.130	4.114	3.948	4.064	4.139	3.801	3.967	3.969
F	1 or 2	F	4.083	3.667	3.976	3.909	3.766	3.943	3.980	3.896
M	1 or 2	M or F	3.864	3.879	4.115	3.953	4.092	4.228	4.220	4.180
F	1 or 2	M or F	4.106	3.891	3.962	3.986	3.952	3.872	3.973	3.933
M or F	1 or 2	M	3.960	3.906	4.015	3.960	4.154	3.994	4.062	4.070
M or F	1 or 2	F	4.010	3.864	4.063	3.979	3.890	4.107	4.132	4.043
M or F	2	M or F	4.020	4.021	4.102	4.048	4.138	3.863	4.019	4.006
M or F	1	M or F	3.950	3.748	3.976	3.891	3.906	4.238	4.175	4.106
M or F	1 or 2	M or F	3.985	3.885	4.039	3.970	4.022	4.050	4.097	4.056

Sib's-Sex-Group Differences

9. Children whose sib was opposite in sex, if the former were first-borns and very near the sib in age, were judged to recover more slowly and less adequately from emotional disturbances than children from parallel groups where the sib was the same in sex. At the middle spacing those from opposite-sex sib pairs were rated the higher (Tables 2, 10).

10. When the child and his sib were four to six years apart in age, those subjects from mixed-sex sib pairs were gauged to have the more nervous habits or show them more frequently (Tables 8, 10).

11. The health assessment for first-borns whose sib was not of their sex and was less than four years younger was better than that for the

TABLE 5

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: SELF-CONFIDENCE AND FINALITY OF DECISION

Subgroup			Self-Confidence				Finality of Decision			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	3.806	4.006	4.284	4.032	3.869	3.987	4.463	4.106
M	2	F	3.543	4.033	3.757	3.778	4.103	4.089	3.756	3.983
F	2	M	3.984	4.304	3.856	4.048	4.291	4.721	3.850	4.287
F	2	F	4.119	3.584	4.007	3.904	4.404	3.593	4.251	4.083
M	1	M	3.782	3.854	4.167	3.934	3.855	4.079	4.093	4.009
M	1	F	3.976	4.528	3.996	4.167	4.013	3.947	4.190	4.050
F	1	M	4.432	4.262	4.351	4.348	3.908	4.435	3.886	4.077
F	1	F	4.189	4.078	4.126	4.131	3.846	3.735	3.642	3.741
M	2	M or F	3.675	4.019	4.021	3.905	3.986	4.038	4.109	4.044
F	2	M or F	4.052	3.944	3.932	3.976	4.348	4.157	4.050	4.185
M	1	M or F	3.879	4.191	4.081	4.050	3.934	4.013	4.141	4.029
F	1	M or F	4.311	4.170	4.238	4.240	3.877	4.085	3.764	3.909
M or F	2	M	3.895	4.155	4.070	4.040	4.080	4.354	4.156	4.197
M or F	2	F	3.831	3.808	3.882	3.841	4.253	3.841	4.003	4.033
M or F	1	M	4.107	4.058	4.259	4.141	3.882	4.257	3.989	4.043
M or F	1	F	4.083	4.303	4.061	4.149	3.929	3.841	3.916	3.895
M	1 or 2	M	3.794	3.930	4.226	3.983	3.862	4.033	4.278	4.057
M	1 or 2	F	3.759	4.280	3.876	3.972	4.058	4.018	3.973	4.016
F	1 or 2	M	4.208	4.283	4.103	4.198	4.099	4.578	3.868	4.182
F	1 or 2	F	4.154	3.831	4.066	4.017	4.125	3.664	3.946	3.912
M	1 or 2	M or F	3.777	4.105	4.051	3.978	3.960	4.026	4.125	4.037
F	1 or 2	M or F	4.181	4.057	4.085	4.108	4.112	4.121	3.907	4.047
M or F	1 or 2	M	4.001	4.106	4.165	4.091	3.981	4.306	4.073	4.120
M or F	1 or 2	F	3.957	4.056	3.971	3.995	4.091	3.841	3.960	3.964
M or F	2	M or F	3.863	3.982	3.976	3.940	4.167	4.098	4.080	4.115
M or F	1	M or F	4.095	4.181	4.160	4.145	3.906	4.049	3.953	3.969
M or F	1 or 2	M or F	3.979	4.081	4.068	4.043	4.036.	4.073	4.016	4.042

children in parallel groups who had a sib of the same sex; whereas, among second-borns at the closest spacing, those with a sib identical in sex were judged healthier than those with a sib differing in sex (Tables 9, 10).

12. When their sib was male and differed in age by two to four years, boys were judged more apprehensive in social situations than girls; but, when the sib was female, girls were judged the more apprehensive (Tables 3, 10).

13. Children with a male sib were rated higher in sensitiveness than those with a female sib (Tables 7, 10).

14. The subjects whose sib was opposite in sex and either older or younger by two to four years received a higher mean rating in self-confi-

TABLE 6

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: TENDENCY TO PROJECT BLAME AND TENDENCY TO ALIBI

Subgroup			Tendency to Project Blame				Tendency to Alibi			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	4.234	4.027	4.404	4.222	4.194	3.927	4.233	4.118
M	2	F	4.110	3.871	4.169	4.050	4.124	3.844	4.353	4.107
F	2	M	3.753	3.806	3.938	3.832	3.370	3.500	3.813	3.561
F	2	F	3.829	4.006	4.057	3.964	3.915	3.963	3.937	3.938
M	1	M	4.005	4.269	3.978	4.084	4.139	4.248	4.169	4.186
M	1	F	3.959	4.489	3.970	4.140	4.023	4.650	4.002	4.225
F	1	M	4.176	3.784	4.553	4.171	3.938	3.709	4.361	4.003
F	1	F	3.683	4.043	4.000	3.909	3.825	4.194	3.986	4.002
M	2	M or F	4.172	3.949	4.287	4.136	4.159	3.885	4.293	4.112
F	2	M or F	3.791	3.906	3.997	3.898	3.643	3.732	3.875	3.750
M	1	M or F	3.782	4.379	3.974	4.112	4.081	4.449	4.086	4.205
F	1	M or F	3.929	3.914	4.277	4.040	3.882	3.952	4.173	4.002
M or F	2	M	3.993	3.917	4.171	4.027	3.782	3.713	4.023	3.840
M or F	2	F	3.970	3.939	4.113	4.007	4.020	3.903	4.145	4.023
M or F	1	M	4.091	4.027	4.265	4.128	4.039	3.979	4.265	4.094
M or F	1	F	3.821	4.266	3.985	4.024	3.924	4.422	3.994	4.113
M	1 or 2	M	4.119	4.148	4.191	4.153	4.167	4.088	4.201	4.152
M	1 or 2	F	4.035	4.180	4.069	4.095	4.073	4.247	4.177	4.166
F	1 or 2	M	3.965	3.795	4.245	4.002	3.654	3.605	4.087	3.782
F	1 or 2	F	3.756	4.025	4.028	3.936	3.870	4.078	3.961	3.970
M	1 or 2	M or F	4.077	4.164	4.130	4.124	4.120	4.167	4.189	4.159
F	1 or 2	M or F	3.860	3.910	4.137	3.969	3.762	3.842	4.024	3.876
M or F	1 or 2	M	4.042	3.972	4.218	4.077	3.911	3.846	4.144	3.967
M or F	1 or 2	F	3.895	4.102	4.049	4.016	3.972	4.163	4.069	4.068
M or F	2	M or F	3.982	3.928	4.142	4.017	3.901	3.808	4.084	3.931
M or F	1	M or F	3.956	4.147	4.125	4.076	3.981	4.200	4.130	4.104
M or F	1 or 2	M or F	3.969	4.037	4.134	4.046	3.941	4.004	4.107	4.017

dence than parallel subjects whose sib was of their own sex (Tables 5, 10).

15. Girls with a brother differing two to four years in age exceeded girls with a sister in the rating they received on finality of decision, while sib's-sex-group differences among boys were insignificant. Children whose sib was of like sex and older by four to six years were rated less vacillating than comparable children whose sib was of unlike sex (Tables 5, 10).

16. The judgments for cheerfulness were more favorable for children whose sibling was dissimilar in sex than for those whose sib was of similar sex, when the sib disparity in age ranged from two to four years (Tables 4, 10).

TABLE 7

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: INDIRECTNESS OF RESPONSE TO FEAR AND FRUSTRATION AND SENSITIVENESS*

Subgroup			Indirectness of Response to Fear and Frustration				Sensitiveness*			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	4.276	4.124	4.398	4.266	4.190	3.959	3.991	4.047
M	2	F	3.885	4.069	4.328	4.094	3.854	3.665	3.699	3.740
F	2	M	3.386	3.586	3.931	3.634	4.035	4.216	4.093	4.114
F	2	F	3.815	4.333	3.761	3.970	4.323	3.699	4.288	4.104
M	1	M	3.992	4.566	4.114	4.224	4.015	4.009	4.401	4.142
M	1	F	4.061	4.469	4.283	4.271	3.700	3.723	4.233	3.885
F	1	M	3.699	3.746	4.118	3.854	4.151	4.192	4.323	4.222
F	1	F	4.161	3.604	3.931	3.898	3.998	4.120	3.791	3.970
M	2	M or F	4.080	4.097	4.363	4.180	4.022	3.812	3.845	3.893
F	2	M or F	3.600	3.959	3.846	3.802	4.179	3.958	4.190	4.109
M	1	M or F	4.026	4.518	4.198	4.247	3.858	3.866	4.317	4.013
F	1	M or F	3.930	3.675	4.024	3.876	4.074	4.156	4.057	4.096
M or F	2	M	3.831	3.855	4.164	3.950	4.113	4.087	4.042	4.080
M or F	2	F	3.850	4.201	4.044	4.032	4.089	3.682	3.994	3.922
M or F	1	M	3.845	4.156	4.116	4.039	4.083	4.100	4.362	4.182
M or F	1	F	4.111	4.037	4.107	4.085	3.849	3.992	4.012	3.927
M	1 or 2	M	4.134	4.345	4.256	4.245	4.103	3.984	4.196	4.094
M	1 or 2	F	3.973	4.269	4.305	4.182	3.777	3.694	3.966	3.812
F	1 or 2	M	3.542	3.666	4.024	3.744	4.093	4.204	4.208	4.168
F	1 or 2	F	3.988	3.968	3.846	3.934	4.160	3.910	4.040	4.037
M	1 or 2	M or F	4.053	4.307	4.281	4.214	3.940	3.839	4.081	3.953
F	1 or 2	M or F	3.765	3.837	3.935	3.846	4.127	4.057	4.124	4.102
M or F	1 or 2	M	3.838	4.005	4.140	3.994	4.098	4.094	4.202	4.131
M or F	1 or 2	F	3.980	4.119	4.076	4.058	3.969	3.802	4.003	3.924
M or F	2	M or F	3.840	4.028	4.104	3.991	4.101	3.885	4.018	4.001
M or F	1	M or F	3.978	4.096	4.111	4.062	3.966	4.011	4.187	4.055
M or F	1 or 2	M or F	3.909	4.062	4.108	4.026	4.033	3.948	4.102	4.028

Sib-Age-Difference-Group Disparities

17. Among first-borns there tended to be an increase with spacing in speed of emotional recovery, whereas in the case of second-borns there tended to be a decrease (Tables 2, 10).

18. Activeness in boys was, in the main, positively correlated with the degree of sib age disparity. No similar trend was observed for girls (Tables 8, 10).

TABLE 8

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: NERVOUS HABITS AND AMOUNT OF GROSS ACTIVITY*

Subgroup			Nervous Habits				Amount of Gross Activity*			
Subject		Sibling	Age Difference between Siblings in Months							
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total	7-24	25-48	49-72	Total
			Score Means				Score Means			
M	2	M	4.247	4.035	3.889	4.057	3.563	4.110	4.637	4.103
M	2	F	4.426	4.042	4.215	4.228	3.936	4.380	4.451	4.256
F	2	M	3.948	3.724	4.211	3.961	3.803	3.856	3.706	3.788
F	2	F	3.854	3.734	3.633	3.740	3.796	3.764	3.847	3.802
M	1	M	4.120	3.635	3.583	3.779	3.915	4.468	4.545	4.309
M	1	F	3.908	4.334	4.001	4.081	3.599	4.892	4.042	4.178
F	1	M	4.170	4.106	4.154	4.143	4.084	4.166	3.973	4.074
F	1	F	3.832	4.292	4.071	4.065	3.509	3.804	3.844	3.719
M	2	M or F	4.337	4.038	4.052	4.142	3.749	4.245	4.544	4.180
F	2	M or F	3.901	3.729	3.922	3.850	3.799	3.810	3.777	3.795
M	1	M or F	4.014	3.985	3.792	3.930	3.757	4.680	4.293	4.243
F	1	M or F	4.001	4.199	4.112	4.104	3.797	3.985	3.908	3.897
M or F	2	M	4.098	3.879	4.050	4.009	3.683	3.983	4.172	3.946
M or F	2	F	4.140	3.888	3.924	3.984	3.866	4.072	4.149	4.029
M or F	1	M	4.145	3.871	3.868	3.961	3.999	4.317	4.259	4.192
M or F	1	F	3.870	4.313	4.036	4.073	3.554	4.348	3.943	3.949
M	1 or 2	M	4.183	3.835	3.736	3.918	3.739	4.289	4.591	4.206
M	1 or 2	F	4.167	4.188	4.108	4.154	3.768	4.636	4.247	4.217
F	1 or 2	M	4.059	3.915	4.182	4.052	3.943	4.011	3.839	3.931
F	1 or 2	F	3.843	4.013	3.852	3.902	3.653	3.784	3.846	3.761
M	1 or 2	M or F	4.175	4.012	3.922	4.036	3.753	4.462	4.419	4.212
F	1 or 2	M or F	3.951	3.964	4.017	3.977	3.798	3.897	3.843	3.846
M or F	1 or 2	M	4.121	3.875	3.959	3.985	3.841	4.150	4.215	4.069
M or F	1 or 2	F	4.005	4.101	3.980	4.028	3.710	4.210	4.046	3.989
M or F	2	M or F	4.119	3.884	3.987	3.996	3.774	4.027	4.160	3.987
M or F	1	M or F	4.008	4.092	3.952	4.017	3.777	4.332	4.101	4.070
M or F	1 or 2	M or F	4.063	3.988	3.970	4.007	3.776	4.180	4.131	4.029

19. When the middle spacing is compared with the close, first-born boys at the former spacing scored the higher in readiness to anger, while second-born boys scored the lower. No significant spacing-group differences are to be noted in the case of the girls (Tables 4, 10).

20. As sib age disparity widened, there was an increase in self-confidence among boys with a brother, while among boys with a sister a peak occurred at the middle spacing and among F2F's a trough was exhibited (Tables 5, 10).

21. F1M's and F2M's manifested a maximum in finality of decision at the middle spacing, while F2F's at the same age-difference level evi-

TABLE 9

MEANS OF THE NORMALIZED RATINGS FOR THE VARIOUS SUBGROUPS: HEALTH

Subgroup			Health			
Subject		Sibling	Age Difference between Siblings in Months			
Sex	Ordinal Position	Sex	7-24	25-48	49-72	Total
			Score Means			
M	2	M	3.931	4.060	4.364	4.119
M	2	F	3.436	4.005	3.938	3.793
F	2	M	3.805	4.439	4.053	4.099
F	2	F	4.338	4.076	4.146	4.187
M	1	M	3.739	4.004	4.053	3.932
M	1	F	4.221	4.606	4.185	4.337
F	1	M	4.101	4.288	4.118	4.169
F	1	F	3.698	3.704	4.186	3.863
M	2	M or F	3.683	4.033	4.151	3.956
F	2	M or F	4.072	4.258	4.099	4.143
M	1	M or F	3.980	4.305	4.119	4.135
F	1	M or F	3.899	3.996	4.152	4.016
M or F	2	M	3.868	4.250	4.208	4.109
M or F	2	F	3.887	4.041	4.042	3.990
M or F	1	M	3.920	4.146	4.085	4.050
M or F	1	F	3.959	4.155	4.185	4.100
M	1 or 2	M	3.835	4.032	4.208	4.025
M	1 or 2	F	3.828	4.305	4.062	4.065
F	1 or 2	M	3.953	4.363	4.085	4.134
F	1 or 2	F	4.018	3.890	4.166	4.025
M	1 or 2	M or F	3.832	4.169	4.135	4.045
F	1 or 2	M or F	3.986	4.127	4.126	4.079
M or F	1 or 2	M	3.894	4.198	4.147	4.080
M or F	1 or 2	F	3.923	4.098	4.114	4.045
M or F	2	M or F	3.878	4.145	4.125	4.049
M or F	1	M or F	3.940	4.150	4.135	4.075
M or F	1 or 2	M or F	3.909	4.148	4.130	4.062

denced a low. Among M2M's there was a decrease in vacillation with spacing (Tables 5, 10).

22. Only at the two-to-four-year sib-age-disparity level did the older-sib group receive a higher mean rating on the trait, tendency to alibi, than did the younger-sib group (Tables 6, 10).

23. There tended to be an increase from the close to the middle spacing in the case of first-born boys in indirectness of response, while among F1F's the reverse trend was exhibited. Girls with a brother tended to manifest more indirection the more the sib differed in age (Tables 7, 10).

TABLE 10

ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Speed of Recovery from Emotional Disturbance			Social Apprehensiveness		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	348.45			321.07		
Between groups	23	26.41	1.15		20.06	.87	
Within groups	360	322.04	.89		301.01	.84	
Between replications	15	12.24	.82		10.93	.73	
Residual	345	309.80	.90		290.08	.84	
Between variables							
Between sex groups	1	.18	.18		1.67	1.67	
Between sibling's-sex groups	1	.01	.01		1.58	1.58	
Between ordinal-position groups	1	1.98	1.98		1.30	1.30	
Between spacing groups	2	.50	.25		3.31	1.66	
First-order interactions							
Subject's sex--sibling's sex	1	.14	.14		.73	.73	
Subject's sex--ordinal position	1	.05	.05		.14	.14	
Subject's sex--spacing	2	.08	.04		2.90	1.45	
Sibling's sex--ordinal position	1	.36	.36		.48	.48	
Sibling's sex--spacing	2	.39	.19		1.51	.76	
Ordinal position--spacing	2	5.51	2.76	3.07	.04	.02	
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	.29	.29		.54	.54	
Subject's sex--sibling's sex--spacing	2	5.49	2.74	3.06	3.36	1.68	
Subject's sex--ordinal position--spacing	2	3.52	1.76		.78	.39	
Sibling's sex--ordinal position--spacing	2	.01	.01		1.19	.60	
Third-order interaction							
Subject's sex--sibling's sex--ordinal position--spacing	2	7.91	3.96	4.41	.52	.26	

Sex-Group Differences

24. Boys with an older brother differing in age by less than two years were exceeded by girls with an older brother in speed of recovery of emotional poise, whereas the trend was reversed for first-borns. Girls with a brother two to four years younger were rated higher than boys with a brother similarly spaced, while among second-borns a parallel sex difference did not obtain. M2M(49-72)'s received a higher rating than F2M(49-72)'s (Tables 2, 10).

25. Estimates of the severity and number of nervous habits were higher for second-born boys than girls; whereas among first-borns the sex-difference trend was, if anything, antipodal (Tables 8, 10).

TABLE 10 (*continued*)

ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Cheerfulness			Tendency to Anger		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	278.67			342.91		
Between groups	23	18.99	.83		27.67	1.20	
Within groups	360	259.68	.72		315.24	.88	
Between replications	15	9.62	.64		19.05	1.27	
Residual	345	250.06	.72		296.19	.86	
Between variables							
Between sex groups	1	.04	.04		6.19	6.19	7.21
Between sibling's-sex groups	1	.04	.04		.11	.11	
Between ordinal-position groups	1	2.25	2.25		.83	.83	
Between spacing groups	2	1.38	.69		.39	.20	
First-order interactions							
Subject's sex--sibling's sex	1	3.32	3.32	4.59	.26	.26	
Subject's sex--ordinal position	1	.29	.29		2.53	2.53	
Subject's sex--spacing	2	2.60	1.30		.90	.45	
Sibling's sex--ordinal position	1	.15	.15		.12	.12	
Sibling's sex--spacing	2	.15	.07		2.57	1.28	
Ordinal position--spacing	2	.64	.32		5.72	2.86	3.33
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	.14	.14		1.14	1.14	
Subject's sex--sibling's sex--spacing	2	3.20	1.60		.22	.11	
Subject's sex--ordinal position--spacing	2	2.75	1.38		6.44	3.22	3.75
Sibling's sex--ordinal position--spacing	2	.63	.31		.02	.01	
Third-order interaction							
Subject's sex--sibling's sex--ordinal position--spacing	2	1.40	.70		.24	.12	

26. Boys were judged more active physically than girls only when the sib-age difference was more than two years (Tables 8, 10).

27. Boys, when the sib was female and younger by under four years, received a better rating in health than did girls with a younger sister, but when the younger sib was male, girls received a higher health assessment than boys, though not a significantly higher one. Among second-borns, F2F(7-24)'s were rated higher than M2F(7-24)'s (Tables 9, 10).

28. Second-born boys averaged higher in rating on readiness to anger than did girls; and the same trend, though not marked, appeared among first borns as well, when the sib was female. However, at the close spacing

TABLE 10 (*continued*)

ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Self-Confidence			Finality of Decision		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	320.32			328.26		
Between groups	23	23.30	1.01		29.34	1.28	
Within groups	360	297.02	.83		298.92	.83	
Between replications	15	13.60	.91		21.22	1.41	
Residual	345	282.43	.82		277.70	.80	
Between variables							
Between sex groups	1	1.50	1.50		.00	.00	
Between sibling's-sex groups	1	.99	.99		2.33	2.33	
Between ordinal-position groups	1	3.81	3.81	4.64	2.04	2.04	
Between spacing groups	2	.72	.36		.22	.11	
First-order interactions							
Subject's sex--sibling's sex	1	.78	.78		1.53	1.53	
Subject's sex--ordinal position	1	.28	.28		1.94	1.94	
Subject's sex--spacing	2	3.91	1.95		2.39	1.19	
Sibling's sex--ordinal position	1	.93	.93		.01	.01	
Sibling's sex--spacing	2	.41	.21		5.38	2.69	3.34
Ordinal position--spacing	2	.05	.03		.74	.37	
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	2.02	2.02		.70	.70	
Subject's sex--sibling's sex--spacing	2	5.57	2.79	3.39	7.40	3.70	4.59
Subject's sex--ordinal position--spacing	2	.23	.12		.38	.19	
Sibling's sex--ordinal position--spacing	2	1.59	.80		.25	.12	
Third-order interactions							
Subject's sex--sibling's sex--ordinal position--spacing	2	.50	.25		4.06	2.03	

the girl with a brother was judged higher than the boy with a brother (Tables 4, 10).

29. The rating given boys in social apprehensiveness was higher than that given girls, when the sib-age difference was under two years (Tables 3, 10).

30. When child and sib were near in age, girls were judged more self-confident than boys; but at the middle spacing the sex difference was reversed in the case of the children with a sister (Tables 5, 10).

31. Girls with a male sib were assessed less vacillating than boys when child and male sib differed by two to four years, but M2F's exceeded F2F's (Tables 5, 10).

TABLE 10 (*continued*)

ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Indirectness of Response to Fear and Frustration			Sensitiveness		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	344.93			360.24		
Between groups	23	32.07	1.39		19.32	.84	
Within groups	360	312.86	.87		340.92	.95	
Between replications	15	10.30	.69		14.22	.95	
Residual	345	302.56	.88		326.70	.95	
Between variables							
Between sex groups	1	12.71	12.71	14.50	2.14	2.14	
Between sibling's-sex groups	1	.36	.36		4.45	4.45	4.70
Between ordinal-position groups	1	.45	.45		.19	.19	
Between spacing groups	2	2.73	1.37		1.81	.91	
First-order interactions							
Subject's sex--sibling's sex	1	1.80	1.80		.54	.54	
Subject's sex--ordinal position	1	.02	.02		.43	.43	
Subject's sex--spacing	2	.48	.24		.56	.28	
Sibling's sex--ordinal position	1	.04	.04		.30	.30	
Sibling's sex--spacing	2	.78	.39		.58	.29	
Ordinal position--spacing	2	.28	.14		1.63	.81	
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	1.31	1.31		.51	.51	
Subject's sex--sibling's sex--spacing	2	3.12	1.56		.72	.36	
Subject's sex--ordinal position--spacing	2	5.38	2.69	3.07	2.69	1.35	
Sibling's sex--ordinal position--spacing	2	2.40	1.20		1.02	.51	
Third-order interaction							
Subject's sex--sibling's sex--ordinal position--spacing	2	.22	.11		1.74	.87	

32. M2M's at the over-four-year spacing were judged more final in decision than F2M's; but, when the sib was female, the trend was reversed (Tables 5, 10). Among first-borns at the same spacing level the estimate for M1F's exceeded that for F1F's.

33. Second-born girls at the close spacing were thought more cheerful than boys, whereas, at the two-to-four-year sib-age-difference level, those from opposite-sex pairs were rated more cheerful than those from same-sex pairs (Tables 4, 10).

34. Boys were rather consistently given higher ratings than girls in the traits, tendency to alibi and to respond indirectly to fear and frustration (Tables 6, 7, 10).

TABLE 10 (*continued*)

ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Tendency to Alibi			Health		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	328.41			302.63		
Between groups	23	25.88	1.13		24.06	1.05	
Within groups	360	302.53	.84		278.56	.77	
Between replications	15	14.43	.96		9.67	.64	
Residual	345	288.10	.84		268.89	.78	
Between variables							
Between sex groups	1	7.33	7.33	8.78	.16	.16	
Between sibling's-sex groups	1	.74	.74		.17	.17	
Between ordinal-position groups	1	2.43	2.43		.03	.03	
Between spacing groups	2	1.89	.94		4.33	2.17	
First-order interactions							
Subject's sex--sibling's sex	1	.84	.84		.44	.44	
Subject's sex--ordinal position	1	.72	.72		2.05	2.05	
Subject's sex--spacing	2	.64	.32		.61	.31	
Sibling's sex--ordinal position	1	.88	.88		.58	.58	
Sibling's sex--spacing	2	2.01	1.00		.36	.18	
Ordinal position--spacing	2	1.79	.90		.10	.05	
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	.98	.98		7.23	7.23	9.28
Subject's sex--sibling's sex--spacing	2	1.01	.50		3.99	2.00	
Subject's sex--ordinal position--spacing	2	2.88	1.44		1.71	.86	
Sibling's sex--ordinal position--spacing	2	1.59	.80		.25	.12	
Third-order interaction							
Subject's sex--sibling's sex--ordinal position--spacing	2	.16	.08		2.05	1.02	

Discussion of Group Results

M2M.—The boy with an older brother, when compared with the boy with a younger one, if the sib differed in age by less than two years, was judged as more ready to anger and less apprehensive in physical activities (not quite significant). At the close spacing the former doubtless competes vigorously, has to keep on his toes to defend himself, and is encouraged to fight back. He also, probably, since he is a second-born, has been warned less of the dangers of the physical world and has had his older sib's example to encourage him in the effort to master body control and the physical environment. When the age gap between the members of MM pairs was two to four years and M2M's, hence, were much outclassed

TABLE 10 (*continued*)

ANALYSIS OF VARIANCE FOR VARIOUS TRAITS

Source of Variance	df	Trait					
		Nervous Habits			Amount of Gross Activity		
		Sum of Squares	Estimate of Variance	F	Sum of Squares	Estimate of Variance	F
Total	383	337.80			332.57		
Between groups	23	20.03	.87		49.04	2.13	
Within groups	360	317.76	.88		283.53	.79	
Between replications	15	13.20	.88		8.62	.57	
Residual	345	304.57	.88		274.90	.80	
Between variables							
Between sex groups	1	.17	.17		13.26	13.26	16.64
Between sibling's-sex groups	1	.14	.14		.71	.71	
Between ordinal-position groups	1	.02	.02		.56	.56	
Between spacing groups	2	.68	.34		12.11	6.06	7.60
First-order interactions							
Subject's sex--sibling's sex	1	2.97	2.97		.89	.89	
Subject's sex--ordinal position	1	6.00	6.00	6.80	.02	.02	
Subject's sex--spacing	2	1.73	.87		8.32	4.16	5.22
Sibling's sex--ordinal position	1	.38	.38		2.75	2.75	
Sibling's sex--spacing	2	1.71	.85		.81	.41	
Ordinal position--spacing	2	1.59	.80		2.18	1.09	
Second-order interactions							
Subject's sex--sibling's sex--ordinal position	1	.04	.04		.07	.07	
Subject's sex--sibling's sex--spacing	2	1.48	.74		3.88	1.94	
Subject's sex--ordinal position--spacing	2	.20	.10		1.86	.93	
Sibling's sex--ordinal position--spacing	2	2.41	1.20		1.16	.58	
Third-order interaction							
Subject's sex--sibling's sex--ordinal position--spacing	2	.53	.26		.46	.23	

in ability by their sibs, the former could not have had much expectation of success for themselves and must have functioned chiefly as hangers-on in the brothers' play groups. In spite of this, M2M's at this spacing were judged, in comparison with M1M's, to recover more readily from emotional upset, to be less intense, more cheerful, less likely to anger, and less inclined to be indirect in response to fear and frustration; i.e., M2M's, relative to M1M's at the middle spacing, seem more poised. It is relevant to recall that M2M's not only did not experience displacement as did M1M's, but this displacement for the latter came at a very critical time in their dependency development and probably resulted in their being rather anxious, hostile, and competitive (see References 12, 18, 19). M2M(25-48)'s, on the other hand, doubtless received much protection from their mothers and

possibly a more consistent level of appreciation than M1M's (see Reference 12). Congruent with the hypothesis that M2M's were babied and indulged by the parents though chastened by the sib is the indication in Reference (9) that M2M(25-48)'s made many bids for help and attention from the teacher, who is a sort of mother figure.

Moreover, the brother's type (M1M) showed, contrary to M2M's relative poise, marked signs of stress and jealousy (10) at this two-to-four-year spacing—another fact which lends support to our hypothesis that M2M's probably were having it well. In fact, they seemed to exhibit better adjustment as the sib age gap widened; i.e., the ratings show that M2M's at the widest spacing, in contrast to the close, received a significantly lower rating in vacillation, in readiness to anger, in social apprehensiveness and a higher one in cheerfulness, self-confidence, and activeness. The ratings given the M2M groups also reveal, as the sib age gap broadened, a marked, but not quite significant, change in the positive direction in the case of the traits of health and speed of recovery from emotional upset, as well as a drop in nervous habits. The view that the greater the sib age difference the better adjusted the M2M's were is further bolstered by data we have (10) which indicate that at the widest spacing the boys with an older brother were more sociable and expansive than the boys whose brother was less than two years older. We think the greater sociableness and better adjustment of the M2M's at the wide spacing occurs because, when the sib is very much older, the younger child tends to have more companions of his own choosing, as well as more protection and relative appreciation from his mother—possibly even from his sib—while, at the same time, good vigorous reinforcement for his male sex identification from both his brother and father. Our findings (10) suggest, too, better adjustment of the brothers of the M2M's when the sib spacing was wide than when close—a condition that should make the adjustment of the younger child less stressful. The fact of the better health of M2M's the wider the sib spacing, it is our belief, stems from lesser exposure from the sib. The latter by the time our subjects entered school had probably already had many of the children's diseases and by virtue of his age had also become relatively resistant to colds. Hence he would not have been much of a source of contagion to his five- or six-year-old sib, our subject.

Compared with the boy with an older sister, M2M's seem, at the wide spacing at least, more expansive and poised. M2M's received at the over-four-year sib-age-difference level a lower mean rating in social apprehensiveness and nervous habits and a higher rating in finality of decision, self-confidence, and recovery from upsets. We shall comment on this difference when we discuss the case of M2F in the next section.

M2F.—The boy with an older sister, as stated above, presents a somewhat different picture from the boy with an older brother, at least when the sib-age-difference is over four years. The apparent less expansive ad-

justment of M2F's at the wider spacings, compared with M2M's, may have been due to: (1) sex role conflict and greater exposure to females on the part of the former (M2F's models were chiefly females and the father, if Freudian theory is correct, may have favored the sib); (2) the pressure from the former's rivalrous, dominant, and jealous older sister (see References 9 and 10 and data on F1M for evidence relative to the sister's type); (3) the babying and indulgence the former doubtless received from his mother because he was the younger of her children by much, a male (see Sears *et al.*, 17), and different in sex from the sib. Other findings we have (9, 10) show our M2F's to have been at the widest spacing both less friendly to the teacher and peers and more hostile than our M2M's. The former, according to our interview data, were also particularly given to quarreling with their sibs. M2F's, the wider the spacing, showed less good emotional balance, more gross physical activity, better health, but also more tendency to alibi and to respond indirectly to fear and frustration. The constellation of traits the M2F's exhibited, especially as the age gap between them and their sibs expanded, was that characteristic of somewhat dependent, passive, spoiled children. It is even possible that M2F's health, which was reported less good than the M2M's, was actually good but the former were kept out of school on less provocation by their indulgent mothers. However, M2M's may have been exposed to more diseases by their sibs in their preschool years than were M2F's and hence may have entered school with more immunities. It is worthy of note that M1M's health in the early school years was relatively poor, while F1M's was relatively good. These two groups are the sib types for the M2M's and M2F's.

When M2F's are compared with M1F's, their counterparts among first-borns, we find at the close spacing the two groups differed little, the former having been judged to recover more speedily from disturbance, to have more nervous habits and possibly poorer health. At the widest spacing, where, as was suggested earlier, M2F's seemed somewhat spoiled and ambivalent, they were judged to be less sensitive and more vacillating. M2F(25-48)'s, relative to M1F(25-48)'s, were rated less confident, active, healthy, less given to anger, to alibiing, and to projecting blame, and less intense, excitable, and moody. The former seem to show more poise but also a less dominant attitude than the much threatened but expansive M1F's. We suspect the differences described derive from M2F's being more indulged and having experienced less stress than the M1F's, who were displaced at a critical period in their dependency development [see similar comment above regarding M1M(25-48)'s]. M2F(25-48)'s sib type, like M2M(25-48)'s, seemed goaded by jealousy and was dominant and expansive. Our data give the impression, then, that having an older, in contrast to a younger, sister was probably slightly more stressful for the boy when the sib spacing was very close but clearly less stressful when the spacing was two to four years. The finding may obtain only at the age

level with which we are dealing, for never again will the sib be so attractive. Ordinal position was correlated with a few of the variables in this study, however, when the sib age gap was four to six years; but other data we have (10) indicate M2F(49-72)'s were more withdrawn and less competitive than M1F (49-72)'s.

F2M.—The girls with an older brother, like the boys with an older sister, showed signs of greater passivity and of increased stress when the sib deviated from them most in age—i.e., the ratings indicate that there occurred, as the sib age difference broadened, a decrease in cheerfulness, self-confidence, finality of decision, and speed of recovery from upset, as well as an increase in nervous habits, indirectness of response to frustration, tendency to alibi, resistance, jealousy, criticalness, tendency to bid for adult attention, and to be upset readily by defeat (for a discussion of the latter traits see References 9, 10, 11). Also the wider the sib age difference the less friendly F2M's were to adults, although they increased their bids for attention as the disparity in years between them and their brothers expanded; i.e., as the brothers' dominance increased, his chastening could be less well dealt with, and the advantages he had became ever more apparent. F2M's mothers, moreover, if the theory of cross-sex alliances in the family is correct, possibly may have been more devoted to the sib, who was their first and long their only love. We note in this connection that, when we interviewed the children, they reported with *decreasing* frequency as the sib age difference expanded that they thought the mother sided with them when they quarreled with the sib. F2M's at the wide spacing were, according to another division of our investigation (11), rated low in responsibleness and tenacity—an observation that is congruent with the hunch that these children were frustrated and felt they were competing at a disadvantage. F2M's at the spacings under four years doubtless received a good workout from their brothers but were able to defend themselves to some extent. However, at the widest spacing, when F2M's were clearly no competitors for their sibs in strength or ability and were probably shunned by their brothers and the latters' friends, they might well have felt inadequate and poorly compensated for their lowly status by the protection and indulgence that they, as the youngest in the family, received.

When the girls with an older brother are set in contrast to the girls with a brother correspondingly younger, the picture for the former at the under-two-year sib-age-difference level is perhaps one of better adjustment, as was the case also for M2F's in relation to M1F's. F2M(7-24)'s, in contrast to F1M(7-24)'s, for instance, received ratings indicating a tendency to more rapid recovery from emotional upset, greater cheerfulness, less self-confidence, but also less alibiing and projection of blame. The former did not experience displacement, profited by the parents' experience with the first child, and had to learn to compete with the sib from the first. These are

all influences likely to favor good adjustment. F2M's at the wide spacing, on the other hand, seem relatively more constricted than F1M's, a relation similar to that which held between M2F's and M1F's. The ratings indicate significantly less rapid recovery of emotional balance, less self-confidence, more social apprehensiveness, less tendency to anger, to alibi, to project blame, as well as less sensitiveness. F2M(49-72)'s were also judged less affectionate, less demanding of attention, and less responsive to adults (9). F1M(49-72)'s were long only children and as such were probably given more stimulation by adults, more appreciation and responsibility than were F2M(49-72)'s. The formers' defenses were those more effective with adults, e.g., alibiing; whereas the defenses of the latter were more those of the less able, e.g., silence and withdrawal. It is interesting, apropos of our hypothesis that F2M(49-72)'s were both babied and chastened more than F1M(49-72)'s, that the former were rated high in jealousy, low in responsibleness, and high in dawdling (see References 10, 11). These are lineaments of the dependent child.

Comparing F2M's and F2F's to get leads as to the effect of the sex of the sib, when age difference is constant, we find, in contrast to the relation between M2M's and M2F's, few significant differences. If we pay attention to the middle spacing, where disparities are most numerous, we note F2M's were rated significantly less apprehensive socially, less indirect in response, more self-confident, but also more sensitive than F2F's. Other findings we have indicate the former were less vacillating, less critical, more competitive, friendly, popular, and better leaders (10). At the middle spacing, F2M's, we think, are beginning to find themselves not too welcome in their brothers' play groups and are seeking associates outside the home, whereas F2F's are still functioning as satellites of their older sisters. At the four-to-six-year age-difference level, where, whatever the sex of the sibs, association with them is limited, the only significant disparity between F2M's and F2F's occurred in the case of nervous habits, F2M's being thought to have the more. When, on the other hand, the sibs were nearly the same age, F2M's were judged to alibi less, to be less indirect, and to have less good health. In the main, then, F2M's at the closer spacings seem somewhat more direct or less shy than F2F's. They were, according to other findings of ours (9, 10), less inclined to bid for adult attention, to insist on their rights, to tattle and were more popular. F2M's at the closer spacings had more friends of their own than did the F2F's. This may have been responsible for their greater social effectiveness, as well as account for their less good health. A similar type of relation in the case of health and the sib's-sex variable was described earlier when M2F's were contrasted with M2M's.

F2F.—The girls with a sister older by under two years, when compared with those with a sister younger by less than two years, like the other second-borns in relation to the first-borns at this spacing, seem to have some advantageous traits. They were judged less moody, less fearful of physical

activities (a similar pattern was noted when M2M's were compared with M1M's), less vacillating, and possessed of better health. Probably F2F-(7-24)'s had relatively more of the children's diseases before entering school because of exposure from their older sibs, with whom they played constantly, and thus had more immunity on entering school. F1F's, on the other hand, having associated with a lesser range of children in their preschool years than F2F's and, hence, having probably had fewer children's diseases, doubtless succumbed readily to the infections to which they were exposed at school.

F2F(7-24)'s may have been somewhat better adjusted than F1F(7-24)'s because they had no scars from a displacement experience, had probably been dealt with in a more relaxed fashion than the latter by virtue of being second-borns, had virtually no sex identification problems, and had had practice in associating with children from the beginning. In addition, they had a reasonable chance of holding their own in competition with their sib, since the latter was only slightly older. However, at the middle spacing, when F2F's were clearly outclassed by their sibs and were hangers-on in the sibs' play groups, they scored significantly lower in self-confidence and higher in indirection than did F1F's who, though challenged by the sister, nevertheless felt themselves to be in the driver's seat. At the widest spacing, the F2F's were rated higher in sensitiveness and finality and lower in nervous habits and anger than F1F's. Other evidence we have indicates F2F(49-72)'s were the more jealous and resistant (9, 10). The former, we believe, are still satellites of the sister, though probably not so much so as at the middle spacing, and adopt frequently a pattern of defense favorite with the less able, namely, resistance. This tendency to resist may lie back also of F2F's "decisiveness." If we look at the spacing-group differences among F2F's, we see evidence at the closer spacings of a strong drive to keep up with the sib but evidence of greater passivity, resignation, and dependency when the sib is over four years older. The most stress is suggested at the middle spacing. Comparing, for instance, the children at the under-two with those at the two-to-four-year sib-age-difference level, we note the direction of change was toward greater apprehensiveness, less self-confidence, and less finality. This middle spacing is the level at which, as mentioned above, we believe, F2F's are chiefly hangers-on in the sisters' play groups. F2M's, in contrast, at the middle spacing, because of sex distance (7), probably have already begun to have friends of their own sex, age, and choosing. This may account for the favorable change among F2M's from the close to the middle spacing, while among F2F's the shift seems in the direction of greater tension or dependence. The reversing of the direction of change in the F2F's, relative to the F2M's, it seems reasonable to infer, is due in part to the greater age difference necessary to give those children whose sib is older and similar in sex, as compared with those

whose sib is older and opposite in sex, relative independence from the sib and its companions. Also at the wide spacing, when indulgence of the F2F's might be great because of their being so much the younger sib, we should expect less difference in the treatment meted out to the members of F2F and F2M pairs. When the age difference between the F2F's and their sisters is wide enough so that the former do have associates of their own, our data suggest their emotional-social adjustment takes an upturn. For example, F2F(49-72)'s, relative to F2F's at the two-to-four-year spacing, were judged more self-confident, less vacillating, more cheerful, less indirect, and less moody.

M1M.—M1M's present a rather interesting pattern which seems repeated in some ways in the other groups of first-borns. The ratings of M1M's at the close spacing suggest they were relatively passive and dependent; i.e., low in initiative and not very friendly to their classmates (11, 10) but friendly to adults (9) and indirect. When, however, the sibs of the M1M's were two to four years younger, the latter showed more dominance and were more actively defensive, less adult-oriented, and more resistant. The change, when the two spacing groups are compared, is in the direction of greater emotional intensity, moodiness, indirection, anger, activeness, fewer nervous habits, slower speed of recovery from emotional disturbance, less cheerfulness, and less apprehensiveness in physical activities. It is our hunch that M1M(25-48)'s showed the great drive and stress they did because the sib is at that adorable one-to-four-year age when it receives a great deal of affectionate attention and appreciation from people generally. It gets around on its own, too, and seriously interferes with the older child's activities and possessions. M1M(25-48)'s, it is true, are abler than the sib and can usually defend themselves physically but may experience much frustration partly because they are discouraged by their parents from attacking the sib directly. Some might stress the importance of the picture of the time of arrival of the sib (19) and of the jealousy experiences, taking these to occur in the case of M1M(25-48)'s at a particularly critical period in the latter's dependency learning and hence to cause much stress (see References 12, 18, 19). The attitude of status concern, dominance, alertness in the defense of self interests, built up in the home because of the sib situation, it would be reasonable to expect M1M's to carry over to their peers. Whatever the cause, M1M(25-48)'s dared to lash out. But M1M-(7-24)'s clung more to adults and possibly even to the sibs. Since they had a sib companion near their own age almost from the first and probably were the recipients of treatment from the parents rather similar to that given the brother, this might have caused them to find the latter's companionship sufficiently satisfying to curb somewhat the desire to seek companionship out of the home. M1M(7-24)'s were rated relatively low in friendliness to children, for instance, but in the interview rarely said they thought

they could dispense with the sib. When M1M's sib, on the other hand, is virtually an infant (wide spacing) instead of more nearly his age, we should expect the latter to fire the former's drive little and to interfere inconsequentially with his activities. Consistent with this hunch, we observe that M1M's at the widest spacing, relative to M1M's at the close, were judged to have fewer nervous habits, to be the more cheerful, less moody, more active, and less intense. And, if M1M's whose sibs are younger by four or more years are compared with M1M's at the two-to-four-year spacing, it is to be noted that the former were rated as recovering emotional poise more readily, as more cheerful, less indirect, more apprehensive in physical matters, and less moody. M1M's, it is our belief, tend at all spacings to identify some with the brother and to have their sex identification reinforced by the latter.

In contrast to M1M's, M1F's do not have their sex identification reinforced by the sib and, in addition, may have been deterred more, because the sib was a girl, from attacking her directly, when self interests were threatened. However, in spite of the security-threatening considerations just mentioned, M1M(25-48)'s, we think, have more direct problems with the sib than M1F(25-48)'s do because of more frequent association with the sib. This may account for M1M(25-48)'s being judged the less confident, cheerful, and active. M1M's speed of recovery also was rated less at the middle spacing than was that of the dominant M1F's, and the former were thought to have fewer nervous habits and less good health, as well as to be less self-confident, less active, and less cheerful. At the close spacing, on the other hand, M1M's were rated higher in the speed with which they regained emotional balance after upset but at the same time were thought more apprehensive than M1F's. The pattern of less good health at the closer spacings in the M1M's than among the M1F's has some consistency and may stem from the former having had a less wide range of associates in their preschool years, less exposure to disease, and hence, less occasion to acquire immunities before entering school.

If we pay attention to ordinal-position differences among the MM's, we observe that, when the sibs differed little in age, M1M's were thought to show more constriction than the M2M's. For instance, the former were judged to anger less, to be less excitable, and to be more apprehensive. The former, we think, have been discouraged by the parents from overt expressions of anger and have been contaminated by the parents' anxiety and concern, while M2M's have probably been encouraged to defend themselves, to try to keep up with their older brothers, and to be less apprehensive about physical activities. At the middle spacing M1M's show clearly more tension than M2M's; i.e., the former were rated more intense, moody, less cheerful, more given to anger, slower to recover from emotional disturbances, and possessed of more nervous habits. At the wide spacing, when both groups of boys probably had a somewhat similar amount of parental attention,

M1M's differed from M2M's only in sensitiveness and physical apprehensiveness.

M1F.—Boys with a younger sister show some of the same pattern details as far as spacing-group differences are concerned as do boys with a younger brother. Marked change, for instance, in the direction of greater dominance and active defensiveness occurs between boys with a sister close in age and those with the sister two to four years younger. M1F(25-48)'s, compared with M1F(7-24)'s, were judged to have more nervous habits, to be more active, sensitive, readily angered, self-confident, excitable, intense, to give more alibis, more frequently to project blame, and to be lower in social apprehensiveness. However, the boys with a sister four to six years their junior were thought less on the defensive and less dominant than those with a sister two to four years younger, i.e., as offering fewer alibis and projecting blame less, as less intense, excitable and active, and as more apprehensive in physical activities. The former do not have in the baby sister much of a direct competitor and the parents' behavior toward the baby is, we think, likely to be interpreted as less biased. Moreover, M1F(49-72)'s sibs arrived after they had developed relatively mature social interests—a fact that should make the reduction in parent attention less of a blow for them.

A look at the ordinal-position differences among the M1F's discloses that, at the close spacing, M1F's, compared with the M2F's, scored lower on nervous habits and in speed of recovery from emotional upset, a rather general characteristic of first-borns when the sib is near in age. Compared with the boys with a sister their senior by two to four years, M1F(25-48)'s seem more actively defensive. As stated in the previous section, the ratings given the former indicate that they were more active, possessed of better health, angered more readily, were more excitable, moody, intense, as well as inclined to project blame and alibi more. This tendency to blame-avoidance of first-borns, Sanford *et al.* (15) also noted. In the previous section we explained our opinion that this pattern results from the displacement experience at a critical time, M1F's sex identification conflict, and the great attractiveness of the sib at the ages one to four years. Although at the over-four-year spacing the ordinal-position differences are less marked, M1F's were judged more sensitive and less vacillating than M2F's. Other findings we have (10) show the former at the wide spacing to have been more gregarious, competitive, better leaders, and given less to teasing. On the whole, it looks as if they were somewhat better adjusted than their counterparts among second-borns.

To recapitulate briefly what was elaborated in the previous section, we note, if we contrast M1F's with M1M's, that when the sib was close in age the two groups differed little. M1F's were judged to recover poise less readily, but to be less apprehensive about physical activities and to have better health. They were also thought to be less friendly to their teachers

and peers, more critical and insistent on rights (9, 10); i.e., they seemed under more social tension. At the middle spacing, while the tension signs are very apparent, M1F's appear to be more expansive. Relative to the boys with a younger *brother,* M1F's at the middle spacing were assessed as more healthy, self-confident, cheerful, given to alibiing, active, recovering emotional poise more speedily, and as having more nervous habits. They were also judged more jealous, exhibitionistic, competitive, popular, and better leaders, as well as more friendly to adults and children, inclined to bid for help and attention, and to tattle (9, 10). M1F's at the middle spacing probably have less of a *direct* competitor in the sib than do M1M's, but are much upset by the amount of adult attention the sister receives, this sib of a *different* sex! M1F's, it appears, are much activated by sex rivalry. The companionship status of the sibs of the M1F's, we think, changes most between the close and middle spacing (it is reduced), whereas for M1M's it should be noted, the change is greatest beween the middle and wide spacing. At the latter, where the sib and his sex are less in evidence, M1F's differed little from M1M's, being thought somewhat less active, more moody, and possessed of more nervous habits.

F1M.—The girls with a younger brother, like the M1M's, seem to have been spurred by the brother; but the sib's relative age appears to have made less difference than it did in the case of the latter group. Does the girl have a sufficiently low jealousy limen so that the *fact* of the sib rather than its *character* is the important variable? F1M's were rated very jealous, exhibitionistic, quarrelsome, competitive, insistent on their rights, as well as friendly to their peers and to adults (9, 10). At all spacings the F1M's were adult-centered but at the middle spacing they were somewhat less responsive to adults than at the close or wide, a fact that suggests the middle spacing for the girls, as for the boys previously discussed, was the most difficult one.

If we turn to spacing effects upon the variables on which this study is focused, we find that F1M(7-24)'s were judged more vacillating and less poised than F1M(25-48)'s. The former, relative to F1M(49-72)'s, who had the most association with adults, were thought to recover less quickly from upset, to alibi less, and to be less indirect in response to frustration. The assessments of the F1M(25-48)'s, in contrast with those for the F1M-(49-72)'s, indicate the former were less moody, less vacillating, and less given to projecting blame, to indirection and to alibiing. Apparently F1M's, when the sib is an infant, are taxed little by him directly but suffer or grieve much because of the affectionate attentions the baby receives. Forty per cent of the F1M's at the wide spacing said they wished they could change places with the baby, whereas at the close spacing only seven per cent desired to make this exchange with the sib.

Compared with the girls with a younger sister, F1M's, when the sib was close in age, were judged to anger more readily, to be more active,

more intense, to recover less quickly from disturbance, to be less given to indirect responses to fear and frustration, and more likely to project blame. In other words, having a male sib seems to make the girl more direct and vigorous in defense. In keeping with this picture, F1M's at the middle spacing were rated the less vacillating, more cheerful, and less inclined to alibi; and at the widest spacing, as less apprehensive socially, less intense, and more given to projecting blame. The F1M's, like the M1F's, who were also members of mixed-sex sib pairs, were much stimulated and their dominance, we think, was motivated in part by sex rivalry. But the F1M's may also have had less contact with their sibs than did the F1F's and have sought, to a greater extent, companionship with children out of the home. If this is the case, the former might be expected to be more dominant in their social relations. It is significant in relation to the question of the associates the child has out of the home that the F1M's expressed, with a relatively high frequency, a preference to play with some child other than the sib. It is also interesting that the sibs, if the M2F type is any indication of what the former were like, were probably rather docile, mother-centered, mother-indulged, and withdrawn, although quarreling much with their dominant older sisters (9, 10).

F1F.—The girls with a younger sister showed the expected signs of inflation in tension as the sib spacing increased from under two years to two to four years, but, of course, not so great a change occurred as did among the males. Girls with a sister two to four years their junior, as compared with those whose sib was less than two years younger, received a higher mean rating on nervous habits and tendency to project blame and a lower rating on cheerfulness and indirection. The reader will remember we have already suggested why there may be an increase in tension at the middle spacing and have offered some hypotheses as to why the girls show less increase than the boys. This discussion we shall not repeat here. Among F1F's, changing in the direction of increase over the whole range as the sib age difference widened were the traits, health, excitability, and intensity. Moodiness, on the other hand, decreased. The waxing in excitability, intensity, and anger as the spacing increased may be due in part to F1F's decreasing experience with children. F1F(49-72)'s may have been very excited when playing with peers at school because this was a relatively infrequent happening for them. F1F(49-72)'s were long only children. They probably were contaminated by the anxiety their parents had relative to them because they were the parents' first contact with children, and they were doubtless subjected to this contamination in a less dilute form than were those whose sibs arrived earlier in their lives.

For a discussion of what in F1F's behavior may be associated with the sib's-sex and ordinal-position variables, the reader is referred to the sections describing the F1M's and the F2F's.

Summary Comments

Although no detailed summary of the interrelations of all of the variables with which we were concerned would be feasible (for this, the reader is referred to pages 397 to 409), let us here comment briefly on a few of the major trends in our data. It is clear that birth-order differences which obtain at the under-two-year spacing may not obtain at the wider spacings. Ordinal-position-group differences at the close spacing, we think, reflect to a relatively greater extent direct sib interaction effects, whereas at the wider spacings the differences are increasingly expressions of child-parent relations, conditioned, to be sure, by the fact of the sib and his relation to the parents.

First-borns at the close spacing were judged to recover less readily from upsets as well as to anger less than second-borns. The former have more status to defend than the latter but are handicapped in a direct struggle with the sib by parental restraints. Hence the former are likely to be more concerned over their defeats. Also first-borns, we think, have stronger superegos. Their parents, unaccustomed to children when their first arrived, have expected more of them than is usual for later children. Second-borns, who are encouraged to defend themselves against the sib, are, on the other hand, less hesitant to express their anger and to attack directly than are first-borns.

To our surprise (15), first-borns were rated the more self-confident, a condition we now think may have stemmed from their being the abler members of the sib pairs. The self-confidence ratings, however, were based on school behavior. Since first-borns tend to be more adult-centered or oriented, the latter attitude may appear to the teacher as confidence. Indeed, in a school situation over which an adult presides, first-borns may be more self-confident than second-borns.

We had also expected first-borns generally to show more nervous habits than second-borns because a higher standard of impulse control is expected of them by adults (15). The "nervous habits," we thought, might reflect the drainage of tension. The fact that second-born males exhibited more nervous habits than did first-borns has made us reconsider. The second-borns *also* are curbed and frustrated but for a different reason, namely, their ineffectiveness in defending themselves against the older sib. This state of affairs may generate much tension. However, as explained earlier, we are not certain that the so-called nervous habits are reflections chiefly of emotional-social disturbance. We have the hunch that local irritations often are the instigators of what we name nervous habits; e.g., dry corneas, tight clothing, caked mucous in the nose, rough skin, hang-nails, skinned knuckles, or callouses. In the light of this surmise, we might hypothesize that second-born males acquire more local irritations in their efforts to keep up with the older sib and through these bruisings *et cetera,* more

nervous habits. Since girls are less active and less given to anger, ordinal-position differences in nervous habits among them may reflect more the operation of their superegos than is the case for boys. If this is the situation, first-born girls should exhibit more nervous habits than second-born, which according to our findings, they do.

Another ordinal-position difference we find interesting is that among first-borns the children from opposite-sex sib pairs tended to have better health than those from same-sex pairs, while this pattern was reversed among second-borns. Contrary to the findings of Kingsley and Reynolds (6), we noted no simple ordinal-position differences in health. If our measure of health is a valid one, we think the above finding may mean the following: First-borns whose sibs are opposite in sex are more likely to seek associates of their own sex and age out of the home and thus are exposed to more contagion. They may, hence, acquire many immunities before entering school and thus succumb less frequently to disease in the early grades in school than do the previously less exposed children from same-sex pairs. The pattern of health among first-borns we would expect to produce the pattern of health we observe among second-borns. If the first-born in his early school years has a period of good health, then the second-born sib should be less exposed to disease and hence have less opportunity to acquire immunities, a condition that should result in less good health for him in the early grades in school. We think it possible, too, that second-borns from opposite-sex pairs, in contrast to those from same-sex pairs, are exposed more at school age to a wider range of children. Because of the phenomenon of sex distance (8), they may be cut off some from the friends of their school-age sib and this encourages them to seek associates of their own. This results in their having direct or indirect contact with more children and hence there is a greater likelihood of their exposure to contagion than is the case in the second-borns whose sib is of the same sex and whose playmates hence overlap much with those of the sib. When the sib is an infant or very much older than the child, then its sex we should expect to have little effect on the latter's associates and hence on their health. Our finding of a lack at the wide spacing of significant sib's-sex-group differences in health is congruent with the expectation stated.

If we turn to our data bearing on the effect of the sib's-sex variable, we note more signs of stimulation or stress among the members of pairs whose sib was different in sex than among members of sib pairs similar in sex, though the spacing and ordinal-position variables often interact significantly with the sib's-sex variable (see also References 9, 10, 11). The interaction of ordinal position, spacing, child's-sex, and sib's-sex variables in the case of health, we have already discussed. We observe also that the girl with the younger brother was noticeably on the *qui vive*. The most conspicuous sib's-sex group differences seemed to occur at the two-to-four-year sib-age-difference level. At this level the children whose sib was of a

different sex from themselves seemed more self-confident, more cheerful, active, healthy, less vacillating, and more inclined to recover poise readily than the children whose sib was like them in sex. Apparently sex rivalry is stimulating. Or sib interests overlap somewhat less when the children differ in sex and direct sib conflict hence is less (7). In addition children from opposite-sex sib pairs may have a greater range of child companions and play less frequently, if second-borns, the role of satellites in their sibs' play groups.

It is also worthy of note among sib's-sex relations that children with a brother were judged less sensitive than those with a sister. Since the culture expects the male to take it on the chin, it may be this attitude is communicated directly or indirectly by the male to his sib. It is relevant in this connection that, in the main, our male subjects were rated less sensitive than the females, the p for the sex-group difference falling only slightly short of 5 per cent (Tables 7, 10).

Since the spacing variable was related in a very complex fashion to our other variables, we shall attempt no description here of the web of relations. Let us merely say that spacing differences seem greater in the case of the males than females. The two-to-four-year spacing, especially for the first-borns, appeared to be a stimulating and/or stressful one, though the meaning of the indications is not so clear as in other data we have reported (9, 10). Confidence, emotional intensity, excitability, moodiness, anger, decisiveness, alibiing, projecting of blame, and indirection, all tended to be high among first-born males at the middle spacing, as compared with those at the close spacing. The boys seemed stung to the quick by the attentions their one-to-four-year-old sibs received, particularly if the sibs were sisters. When the sibs are very near in age, they get more nearly similar treatment, a fact which no doubt accounts in part for the lesser stress at the close spacing.

In the main, gross activity and possibly health were positively correlated with spacing. We suspect the more the sibs differ in age the less they expose each other to diseases, or the narrower their range of child associates and the more time they spend with adults. These considerations may account for the positive relation between health and physical activity and spacing.

Simple sex differences occurred rarely. Boys generally were judged more active than girls, as well as more likely to anger, to alibi, and to give an indirect response to fear and frustration; but, even in these traits, with the exception of alibiing, sex interacts with the other independent variables.

Some of our findings we think are a function of the age group studied. This consideration and the complexity of the interrelationships uncovered suggests the need for much more exploring of the question of the effects of sibling characteristics on the personalities of children.

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A METHOD FOR DETERMINING THE POLARITY OF BEHAVIOR ITEMS [1]

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Personality theories are replete with bipolar concepts: love-hate, introversion-extraversion, masculinity-femininity, manic-depressive, pleasure-pain, and so forth. Research workers have sought to identify behavior items which can be considered indicative of one or the other pole of such bipolar traits.

The diagnostic significance of behavior items is often investigated by comparing observations made on contrasting reference groups. An example of this procedure is seen in Terman and Miles's (8) establishment of a masculinity-femininity scale by comparing the answers of men and women to a series of questionnaire items. It will often occur, however, that no clear reference groups are available to tie down the ends of the continuum. Also, the significance of a particular behavior item may be arguable, some theorists urging that it belongs to one end of the continuum, and others maintaining precisely the opposite. There is a place, therefore, for a technique which will provide some objective way of determining the scoring of behavior items when no external criterion is available.

The method presented here is applicable in the case where a sizable number (say, at least 10) of behavior items are postulated to have in com-

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[2] We wish to thank Gertrude Tourtellot and Lucile Bennis for their help with the computations.

mon some relevance to a certain bipolar trait, and where it is desirable to allocate each item to a position on this continuum. In simple terms, the method is designed to tell whether a certain item is to be scored "plus" or "minus." The source data enter into the analysis in a dichotomized form, either as the simple presence or absence of the behavior in question or as a result of cutting the response distribution at some point, preferably near the median. The chief outcome of the method is a specification of the polarity of each item, together with an indication of the extent to which each item is relevant to the underlying trait. If desired, the results may be used to select those items which appear to measure the trait most strongly, as shown by factor loadings. It is required, of course, that data on all behavior items to be considered be available on each member of a suitably large sample of individuals.

It cannot be too strongly emphasized that the method depends on the assumption that there is a single common dimension (either "pure" or complex) underlying all or most of the items, and that the total pool of items used in the computations provides the best basis, at least initially, for establishing that dimension. There are several obvious variations or extensions of the method, however, which may serve to minimize the dangers attending the assumption of a single dimension. For example, one could apply the method to an initial set of items in which one has high confidence, later adding other items on the basis of whether they correlate significantly with the scores established on the initial set. If large numbers of items are available, one could also apply the method iteratively, successively refining the sets of items which are at the extremes of the polarity or even applying the method to the residual set of items not found at the extremes.

Rationale and Procedure

Suppose we have a set of n variables each of which has been scored dichotomously; that is, each item can be scored as either "plus" or "minus," or as "zero" or "one," for example. It is assumed that all these n variables measure, with some error, a single polar trait; it is not known, however, to which ends of the trait the "pluses" and "minuses" should eventually be assigned. The "pluses" and "minuses" used in collecting the data may be solely arbitrary.

A criterion for assigning the "pluses" and "minuses" to the respective ends of the continuum is that the variance of the total scores over all variables must be maximized. The most rigorous approach to this problem would be the use of the theory of principal axes; as Horst has shown (5), the first principal axis yields the set of weights which maximizes the variance of the sum of scores. The weights can be either positive or negative, and can vary continuously. The principal axis solution, however, is generally laborious and costly, and would rarely be worthwhile for the type of prob-

lem with which we are concerned here. The present method uses, in effect, the centroid axis, which is usually reasonably close to the principal axis. (Edgerton and Kolbe's claims to the contrary [2] may be discounted because their centroid solution did not allow for sign-reflection.)

Fortunately, the basis for the method can be looked at quite simply as an application of a formula for the variance of a sum, which is as follows:

$$\sigma^2_{(x_1+x_2+\cdots+x_n)} = \sum_{i=1}^{n}\sum_{j=1}^{n} \sigma_i\sigma_j r_{ij}\,; \quad (i, j = 1, 2, \cdots, n).$$

That is, the variance of the sum of all variables (with unit weights) is the sum of all entries in the variance-covariance matrix of the variables. This variance can be altered, however, by changing the signs of some of the variables. (If *all* variables are reflected at the same time, the variance of the sum remains the same.) To maximize the total variance, therefore, it is necessary to find the best way of assigning signs to the variables. In the types of situations with which we are concerned here, it will often be found that many of the array totals of the variance-covariance matrix will be negative, thus counterbalancing some of the positive array sums and yielding a smaller total variance than might be obtained by reflection of the variables. Indeed, if all array sums were positive at the outset, it could mean that the investigator was remarkably sagacious in assigning the initial arbitrary scoring weights. Nevertheless, even when all array sums are positive, it is sometimes possible to obtain an even higher total variance by judicious reflection of pairs of variables, as will be shown below.

The recommended technique for obtaining a maximum total variance is that of sign-reflection, commonly employed in the centroid method of factor analysis. This technique, which is usually applied to matrices of factor residuals but is also applicable to initial correlation or covariance matrices, is presented by several writers on factor analysis, including Thurstone (9, pp. 165-166), Cattell (1, pp. 162-165), and Guilford (3, p. 497). Holley (4) has presented a supplementary procedure which should always be tried after sign-reflection has arrived at the stage where all array sums in the matrix are positive.

In the present case, one does not need to reduce the data to a correlation matrix, or even to a variance-covariance matrix; one can just as well operate on a matrix whose entries are the variances and covariances multiplied by N, for such a matrix is easily computed from frequencies of joint occurrence. If the entry in the ith row and the jth column of this matrix is denoted by b_{ij}, such an entry is computed by the formula

$$b_{ij} = N_{ij} - p_i N_j\,, \qquad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where N_{ij} = the number of cases getting a "plus" or "1" in both variables i and j, p_i = the proportion of cases getting a "plus" or "1" in variable i, and N_j = the number of cases getting a "plus" or "1" in variable j.

One then applies the technique of sign-reflection to this matrix until the grand sum of all arrays is as large as possible. It is always possible to reflect until every array has a positive sum, and Holley's technique should be tried after this stage is reached in order to see whether further sign-reflections are feasible. The variables whose signs are negative at the end of this procedure are, then, the ones to be reversed in scoring.

The final step is not statistical, but solely interpretative: to examine all behaviors which are similarly scored. That is, one examines the behaviors indicated to be at each end of the continuum, in order to decide on labels for these ends. For example, if one is working on masculinity-femininity behavior items, one would examine all behaviors at one end of the continuum to see whether they are typically masculine or typically feminine. In general, items with the highest array sums are those which can be expected to give the clearest evidence on the identification of poles. One can easily, in fact, compute the centroid factor loadings in order to rank the variables with respect to their position on the underlying trait dimension, or in order to select subtests of variables having factor loadings greater, in absolute magnitude, than some chosen value.

The results of this procedure can be regarded as very clear or as only suggestive, depending on the relative size of the array sums and upon the plausibility of the interpretations. It may happen that the initial covariances are very small on the average, in which case the results may actually be due to chance rather than to any common trait measured by the behavior items. At any stage of the sign-reflection process, but most pertinently at the final stage, one may compute the reliability of the sum of variables and test its significance.

It should be pointed out that the polarity of the final scale as a whole is arbitrary; it is conceivable that in two random samples of data the positive end of the continuum in one sample would accidentally correspond to the negative end of the continuum in the other. (To understand this, it may be noted that simultaneous reflection of all variables does not alter the variance of a sum.) Therefore, in cases where one is comparing or contrasting two or more samples it may be desirable to reflect all signs in certain samples; such reflection is further necessary, if one is establishing a scoring system, to insure that the scores will have comparable meanings in all samples.

Computations and Formulas

The procedures and computations will now be illustrated in detail for a small example with six variables, as shown in Table 1. (These data are extracted from the data of a larger study whose results are presented in Table 2; in practice, it is advisable to have at least 10 variables in the analysis). The initial matrix B consists of entries b_{ij} as defined in formula (1).

TABLE 1

ILLUSTRATIVE COMPUTATIONS ($N = 202$)

	9	12	(—) 14	17	33	(—) 37	Σ
9	(50.4)	2.3	1.9	—1.6	23.1	—6.8	18.9
12	2.3	(48.1)	—11.8	4.2	3.9	—7.2	—8.6
14	1.9	—11.8	(50.3)	—7.6	3.6	0.0	—13.9
17	—1.6	4.2	—7.6	(46.1)	—1.4	—7.8	—14.2
33	23.1	3.9	3.6	—1.4	(50.4)	—16.0	13.2
37	—6.8	—7.2	0.0	—7.8	—16.0	(49.2)	—37.8
							Σ(diag.) = 294.5 = D
S	18.9	—8.6	—13.9	—14.2	13.2	—37.8	—42.4
$-\frac{1}{2}S$	—9.45	4.30	6.95	7.10	—6.60	18.90	21.20
+37	—16.25	—2.90	6.95	—0.70	—22.60	*18.90*	—16.60
+14	—14.35	—14.70	*6.95*	—8.30	—19.00	*18.90*	—30.50
C	28.7	29.4	*13.9*	16.6	38.0	*37.8*	164.40 = A
T	79.1	77.5	*64.2*	62.7	88.4	*87.0*	458.9 = $A + D$
a	.260	.254	—.211	.206	.290	—.286	$\sqrt{(202)(458.9)}$ = 304.5

$$r_t = \frac{6}{5} \cdot \frac{164.4}{294.5 + 164.4} = .430$$

$$F = \frac{164.4}{294.5 - (258.9)/6} = .75 \quad ; \quad p > .50$$

$$d.f._1 = 202 - 1 = 201$$

$$d.f._2 = (202 - 1)(6 - 1) = 1005$$

It is well to indicate the diagonal entries in some special way (here they are put in parentheses), as these are not used in the sign-reflection process. The computation steps are:

1. Set up a check column to the right of the matrix B, entries being the sums of nondiagonal entries for each row in the matrix.
2. Add the nondiagonal entries for each column and record in the row labeled S.
3. Divide each entry in S by 2 and reverse its sign, recording the results in the row labeled $-\frac{1}{2}S$.

4. Identify the variable having the highest positive entry in the row labeled $-\frac{1}{2}S$; place a negative sign at the head of its column, then find that variable's *row* in the matrix and add its entries to those of the row labeled row $-\frac{1}{2}S$, recording the results in the row immediately below. Add across and check the result in the check column. The diagonal entry in the matrix is to be regarded as zero, so that in the row below $-\frac{1}{2}S$ the entry corresponding to the diagonal position is the same as the entry in row $(-\frac{1}{2}S)$. (In Table 1, the results are recorded in row "+37," since variable 37 was reflected.) At the same time mark this entry in some special way, e.g., with red pencil, and carry this indication down as long as this variable remains reflected. (Here the special marking is indicated by the use of *italics*.)

5. In the row just recorded, identify the variable having the highest positive total, place a negative sign at the head of its column, then find the variable's row in the matrix and add its entries to those of the row just recorded. The results are recorded in a new row (row "+14" in the example).

6. Continue in this way until no *positive* entries remain for variables *not* reflected, and no *negative* entries for variables *reflected*. (In the case of a negative entry for a reflected variable, that variable's row is subtracted instead of added, and the variable is subsequently treated as an unreflected variable.)

7. Inspect the computations for the possibility that further reflections can be made by reflecting *pairs* of variables (4). This will be the case if an entry in the ith row and the jth column, after it itself has been changed in sign in accordance with any reflections made up to this time, is greater than the absolute sum of the entries in the ith and jth columns of the last row (assuming that that row conforms to the requirements of step 7.) For example, in Table 1 if $b_{(9)(33)}$, which is 23.1, were larger than $|14.35 + 19.00|$, the absolute sum of the corresponding entries in row "+14," one would proceed to reflect first variable 9, then variable 33. However, since this is not the case, this step cannot be illustrated in this example.

8. Being satisfied that no further reflections are possible, multiply each entry in the last increment row by 2 and reverse the signs of the entries for variables not reflected, recording the results in the row labeled *C*. Row *C*'s entries should thus all be positive. The object of the sign-reflection procedure is to maximize the sum of these entries, which are the columnar sums of the entries in the computation matrix *B* after sign-reflection. Add across row *C* to find the sum of the entries; this sum is designated *A* and is used in later work.

9. Find the sum of the diagonal entries of matrix *B*, heretofore not used. This sum is *D*.

10. Add the diagonal entries of *B* to the entries of row *C*, column by column, to form row *T*. Let t_j be the jth entry of row *T*. Then $\Sigma t_j = (A + D)$, and is equal to N times the variance of the total scores on all n variables when they are added together with weights of +1 for unreflected variables and −1 for reflected variables (or the exact opposite).

11. The reliability of the total score obtained by adding together the scores of "1" or "0" on the variables, with unit weights and signs determined by the preceding analysis, may now be computed by the formula

$$r_t = \frac{n}{n-1}\left(\frac{A}{A+D}\right) \quad \text{.....(2)}$$

To test the significance of this reliability under the hypothesis of zero reliability in the population, evaluate the following F ratio:

$$F = \frac{A}{D-(A+D)/n} \quad \text{.....(3)}$$

with $d.f._1 = (N-1)$ and $d.f._2 = (N-1)(n-1)$. (These formulae are derived and adapted from those presented by Hoyt [6] for the case of multiple-item tests.)

12. If desired, compute the final centroid loading for any variable j by the formula

$$a_j = \frac{t_j}{\sqrt{N\Sigma t_j}} \quad \text{.....(4)}$$

(This uses unities in the diagonal of the correlation matrix corresponding to matrix B. Alternatively, one may replace the diagonal elements of matrix B with values which will be $N\sigma^2_j$ times the estimated communalities of the variables. For example, one may use the highest value in each array as a substitute for the diagonal entry.)

If a sufficient number of cases are available, it may be advisable to apply the procedure to two random halves of the sample in order to note whether the results are consistent.

Illustrative Example

The need for the technique outlined above became evident in the course of studies now under way at the Harvard Laboratory of Human Development. These studies are concerned with the child-rearing antecedents of identification in young children. One aspect of identification is the extent of super-ego development. The function of the super-ego, according to psychoanalytic theory, is to control the impulsive behavior of the individual. It is an end-product of the child's identification with his parents, and represents an internalization of the parents' values as to what are right and wrong behaviors. In addition, a child with a well-developed super-ego has taken over from his parents the prerogative of punishing himself for wrongdoing as well as that of rewarding himself for behaving in a manner which the parents heretofore approved and rewarded. In other words, one significant aspect of super-ego development is a shift in the control of behavior from control by rewards and punishments administered by some agent in the child's environment to internal controls which operate even when the external controlling situation does not operate or ceases to exist.

With this theory as a background, super-ego development is thought to be amenable to operational definition and measurement in terms of the number and kind of responses the child makes to a series of childhood "deviations" or wrongdoings presented to him in a doll-play, make-believe situation.[3] It was postulated that children's responses in this situation could be ordered along a continuum ranging from "guilt" to "fear," the former being represented by instances of punishment to the self, and the latter by such signs as escape from a potential, external punisher. To the extent that the child gives responses manifesting "guilt," the child can be said to exhibit super-ego development. It is also conceivable that super-ego development would be represented by instances in which the child depicts adult-like behaviors, and thus, we may infer, shows identification with parents.

The responses to the doll-play situation could, of course, be scored and interpreted purely in an *a priori* manner on the basis of the theory outlined above. Such a procedure would be highly subjective, however, and is hardly to be preferred over any method which would appeal to the actual nature of the data. The method described in the first part of this paper was developed for the purpose of establishing a bipolar continuum and assigning the behavior responses to one end or the other of this continuum. It was necessary to assume only that all the items could be described in terms of *some* continuum, but it was not necessarily assumed that this continuum was a guilt-fear continuum.

The data used in the present study were behavioral observations of children collected in a situation designed specifically to elicit acts which could be ordered theoretically along a bipolar dimension which was tentatively called "guilt-fear." The subjects were 202 boys and 177 girls, all five years old. Prior to the guilt-fear observation session, all the children had been observed in two sessions of regular doll play, by a method which is described elsewhere (7). For the guilt-fear session, the experimenter took the child from the kindergarten into an experimental room where there was set up an uncovered, furnished six-room dollhouse, in which a family (father, mother, boy, girl, baby) of small flexible dolls could be manipulated. The experimenter then acted out for the child a series of eight deviations, or childhood wrongdoings, using as the "deviator" or wrongdoer a child doll of the same sex as the subject. An example of one of the eight deviation situations follows:

> The mother puts the baby on the couch. The mother tells the boy to watch the baby while she goes out. The mother tells the boy to watch that the baby does not fall off the couch. The mother goes out. The boy stays for a while. The boy goes out and plays. The baby falls off the couch. What happens now?

[3] This doll play technique for investigating guilt and fear was developed by Drs. Pauline S. Sears (now of Stanford University) and Edgar L. Lowell (now of the John Tracy Clinic, Los Angeles), both formerly of the Harvard Laboratory of Human Development. A complete report is in preparation.

The subject was then permitted to complete the story using any members of the doll family that he chose. The experimenter recorded as many acts as the child used to finish the story. The subject's responses were recorded in a prearranged set of categories, as follows: (1) "fixing" (e.g., the boy put the baby back on the couch); (2) physical punishment (the mother spanked the boy); (3) verbal punishment (the mother says, "You've been a naughty boy"); (4) other punishment (the mother made the boy go to bed); (5) hurt feelings (the boy felt sad); (6) delay (the subject delays giving any relevant response); (7) redefinition (the baby really didn't fall down);

TABLE 2

FACTOR LOADINGS OF BEHAVIOR ITEMS FOR TOTAL SAMPLE AND RANDOM HALF-SAMPLES

Variable	*Boys* (N=202) Total	I	II	*Girls* (N=177) Total	I	II
37 Total Unspecified Agent	.25	.27	.30	.22	.17	.22
36 Total Girl Agent	.19	.23	.14	.27	.27	.32
29 Cs* Agent of "Other" Punishment	.19	.12	.22	.20	.13	.24
20 "Hiding"	.18	.16	.20	.12	.16	.09
8 Cs* Punished by Unspecified Agent	.18	.18	.19	.23	.19	.22
6 Physical Punishment, Cs* to Mother	.17	.16	.17	.09	.06	.10
16 "Feeling Hurt"	.16	.20	.11	.10	—.09†	.10†
14 Verbal Punishment	.15	.16	.15	—.15	—.23	—.11
10 Physical Punishment, Father to Cs*	.14	.14	.21	—.17	—.16	—.20
19 "Confession"	.13	.17†	—.11†	—.14	—.13	—.15
18 "Redefinition"	.13	.19†	—.11†	.17	.09	.23
35 Total Boy Agent	.10	.10	.10	.08	—.12†	.13†
34 Total Father Agent	.03	—.02†	.06†	—.16	—.17	—.16
17 "Delay"	—.17	—.17	—.19	.17	.21	.15
9 Physical Punishment, Mother to Cs*	—.18	—.17	—.14	—.22	—.27	—.22
12 "Fixing"	—.18	—.27	—.20	—.10	.11†	—.11†
28 Mother Agent, "Other" Punishment	—.18	—.11	—.19	—.29	—.29	—.30
33 Total Mother Agent	—.31	—.23	—.28	—.28	—.29	—.25
r_t	.58	.59	.60	.61	.61	.64
F	1.38	1.41	1.48	1.58	1.57	1.81
$d.f._1$	201	100	100	176	88	87
$d.f._2$	3417	1700	1700	3009	1496	1479
p	<.01	<.01	<.01	<.01	<.01	<.01

* Child doll of same sex as subject.

† Discrepancy between samples in sign of factor loading.

(8) confession (the boy told the mother what he has done); and (9) hiding (the boy ran away).

From these data, a large number of variables could be derived, depending on the type of act, the agent and object of the act, etc. The 18 variables listed in Table 2 were selected for study as being theoretically most relevant to the guilt-fear dimension, if it existed. In preparing the data for analysis, the frequency distributions were dichotomized as near their medians as possible; the matrix B was then computed by formula (1). Theoretical considerations and previous results from doll play with children led us to expect different patterns of responses for boys and girls. Consequently, the analysis was done separately for each sex. Also, to provide cross-validations the cases were randomly divided into two groups each for boys and for girls; there were thus six separate analyses in all.

The results of applying the bipolar scoring method are presented in Table 2. The variables are rank-ordered in the table from highest positive to highest negative factor loadings on the basis of the results from "Boys' Total Sample." All factor loadings for the three girls' samples were reversed in sign, since as pointed out above, the polarity of the scale as a whole is arbitrary, and it appeared that the boys' and girls' results could be made to correspond more closely by reversing the signs of the results for one of the sexes.

The reliabilities of the total scores in each of the samples are adequate, and highly significant according to the F test provided by formula (3). In general, the signs and magnitudes of the factor loadings are consistent between random samples of each sex, and even between sexes—though to a lesser extent. For each sex, there are only three variables for which the signs of the factor loadings did not agree in the two samples; these factor loadings are indicated by a dagger (†) in Table 2. In other words, in three of the 18 variables for each sample, the assignment of polarity is obviously questionable. This may be due to unreliability in the measures themselves or to a possible multi-dimensionality in this set of measures.

The final step is the interpretation of the results. This involves the inspection of the positive and negative groupings with a view to identifying what continuum appears to be measured and determining the polarity of this continuum. Variables with the higher factor loadings should be given more weight in this process.

For the boys, not all of the variables at either end of the continuum are interpretable in terms of our original theoretical formulation. The variables with the five highest negative factor loadings, however, seem to be meaningful as guilt indices. As numbered in Table 2, these variables are 33, 28, 12, 9, and 17. The strongest clue to guilt is variable 9, which is the relative amount of physical punishment which the subject represents as being given by the mother doll to the boy doll. Variable 28 again presents the mother as the agent of punishment, this time punishment other than

physical and verbal; nevertheless, as in variable 9, the punishment is usually directed to the deviator. Variable 33, the proportion of scoring units that depict the mother doll as the agent of action, is interpretable as an index of the extent to which the subject identifies with the mother. Variables 17 and 12 are most easily interpeted as indices of guilt: the "fixing" response of variable 12 represents an acceptance by the child that there has been a wrongdoing and he attempts to make retribution by undoing the wrong; "delay" (variable 17) indicates that the child, overwhelmed by the deviation, manifests a "block" so strong that he makes no response whatever, at least initially. In summary, four of the five variables with high negative factor loadings are interpretable as guilt indices and the fifth appears to be an index of identification. This finding supports the theory that guilt is a characteristic of a well-developed super-ego, which in turn is associated with parent-identification.

Variables with high positive factor loadings for the boys are those numbered 37, 36, 29, 20, 8, and 6. "Hiding" (variable 20) is possibly a a sign of fear, in that the deviator is represented as trying to avoid punishment for the transgression. Variables 29 and 6 represent counter-aggression in response to the deviation; that is, the boys add further transgressions to those already depicted. Variables 37 and 36 are difficult to interpret; as indices of actions by agents (either the girl doll or "unspecified" agents) other than the boy doll, they do not at any rate appear to measure behaviors which we would expect guilty children to show, nor do they appear to measure parent-identification. Variable 8 is particularly difficult to interpret as any kind of fear index, since it represents punishment directed against the deviator by "unspecified agents." On the whole, the positively signed variables do not seem to represent the "fear" end of a guilt-fear continuum as originally postulated; rather, they seem to constitute merely the opposites of the guilt and identification behaviors isolated at the other end of the continuum. Possibly the continuum may be thought of as ranging from "identification and guilt" (at the negative end) to "nonguilt" (at the positive end), or perhaps the continuum represents two mutually exclusive ways of evidencing guilt.

The findings for the girls present a generally similar appearance. As in the case of the boys' results, the negative end of the continuum is clearer. The five measures with the highest negative factor loadings, those numbered 28, 33, 9, 10, and 34, seem to represent guilt, in that the action is portrayed through a parent with whom the child is identifying or the action represents the child deviator being punished. The positive end of the continuum, however, is difficult to interpret as representing fear. Some of the variables with positive factor loadings, such as variables 29, 37, and 36, seem to indicate absence of identification with parents. Only "redefinition," variable 18, is an expected sign of fear. It is notable that variable 17, "delay," which was at the negative end of the continuum for boys, grouped with the posi-

tively-loaded variables for the girls. The results for the girls seem to confirm the conclusion reached for the boys' data, namely, that the negative end of the continuum represents guilt and parent-identification, whereas the positive end indicates the absence of these behaviors, or possibly even the rejection of guilt feelings.

It should be pointed out that the data were collected as a part of a larger study designed to relate certain child-training measures to evidences of guilt and fear in children. The method of analysis described here provides a first approximation of guilt and identification scores. It is hoped that the relationships will be further clarified when the data from the child-training measures are analyzed.

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THE EFFECT OF NONDIFFERENTIAL REWARD AND NON-REWARD ON DISCRIMINATIVE LEARNING IN CHILDREN [1]

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In a recent paper Calvin (5) pointed out that his findings on the effect of nondifferential reward and punishment could not be accounted for by Hull's (6) reinforcement theory or Bitterman's (2) concept of perceptual organization, and that some revision of both Hull's and Bitterman's positions seemed necessary. Since that time Bitterman (3) has revised his position considerably to enable him to handle adequately recent experimental findings. The present experiments were designed to extend the investigation of the effect of nondifferential experience utilizing children for the experimental population.

EXPERIMENT I

Apparatus and Procedure

A 28 by 22 in. cardboard screen (which could be raised and lowered for each trial, and which was set in a masking framework of cardboard extending a foot on either side) was used to present all the training and testing trials to the *S*s who were seated beyond arms length on the opposite side of the screen from *E*. Two identical plain opaque red plastic cups were presented mouth down and 4 in. apart. If *S* pointed to the cup with the reward (a small plastic toy of the kind given in gum ball machines) under it, *E* picked up the cup and gave the reward to *S*; whereas if *S* pointed to the cup with nothing under it, *E* first picked up the chosen cup to show that it had not covered a reward and then immediately lowered

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The data in the first experiment were presented at the 1954 APA convention in New York. The second experiment was supported by a grant from the Social Science Research Council.

The senior author is now at Hollins College.

the screen to terminate the trial without giving *S* a reward. Two 3 by 4½ in. white cardboard stimulus cards which served as cues were placed in horizontal positions, one directly in front of each cup.

The *Ss* were 36 elementary public school children who were divided into three groups consisting of 12 *Ss*. Half of each group was randomly chosen from the fifth grade and half from the sixth, with the only restriction being that they be equally made up of males and females. Group I (the control group) had to solve a standard discrimination problem. They had to learn to choose the correct stimulus regardless of the spatial location, which was varied according to a prearranged random order such that neither stimulus appeared more than three times in succession in either position. One stimulus card had three ½ in. medium metallic green gummed stars spaced at ⅝ in. intervals along the center line of the length of the card, whereas the other card had four such stars along the center line. The three starred card was positive for half the *Ss* and the four starred positive for the other half. Group II (the nondifferential reward group) was given 20 training trials in which a plain white card was always negative and a starred card always positive; i.e., on half the trials *S* found white vs. three stars, and on the other half, white vs. four stars, but the starred card was always positive. Upon completion of the training trials, *S*'s from this group were switched to the test problem that Group I worked on, three vs. four stars. Group III (the nondifferential non-reward group) was given 20 training trials in which the starred cards were negative and a plain white card was positive, the reverse of Group II. At the conclusion of the training trials this group also was switched to Group I's problem. A balanced experimental design was used in the presentation of the stimuli to all groups.

The criterion of learning on the test problem was 10 consecutive correct trials. The test problem was terminated at the tenth consecutive correct trial or at the first error after the thirtieth trial, whichever occurred first.

Results and Discussion

Table 1 presents median trials to learn for all groups. Using the Mann-Whitney U Test (8), the following results were obtained (all tests were two-tailed): the difference between Group I, the control group, and Group III, the nondifferential non-reward group, was significant beyond the 5 per cent level; the difference between Group I and Group II, the nondifferential reward group, was significant beyond the 7 per cent level; the difference between Group II and Group III fell far short of significance. Thus the groups that were given nondifferential experience were superior to the control group, and there was no appreciable difference between the nondifferential reward group and the nondifferential non-reward group.

When we compare these findings with those of other experimenters who used rats as *Ss*, we note quite a bit of similarity and some differences. The

superiority of our nondifferential reward group to the control group is in general agreement with the findings of Bitterman, Calvin, and Elam (2) and Bitterman and Elam (3). Billingsley, Feddersen, and Bitterman (1), Bitterman, Elam, and Wortz (4), Calvin (5), and Siegel (9) did not find this superiority. In an experiment in this area using adult humans as *Ss*, Maltzman and Morrissett (7) also failed to find results corresponding to ours. A possible reason for these discrepant findings will be discussed below.

TABLE 1

MEDIAN TRIALS TO LEARN

Group	*Trials*	*No. of Ss Who Failed to Solve*
I. Controls	20	5
II. Nondifferential reward	13	2
III. Nondifferential non-reward	11	3

The fact that the performance of our nondifferential reward and nondifferential non-reward groups are not significantly different is in accord with the findings of Bitterman, Elam and Wortz (4), but Calvin (5) found that his nondifferential reward group was significantly superior to his nondifferential punishment group. The superiority of the nondifferential non-reward group to the control is not in accord with the findings of either Bitterman, Elam, and Wortz or Calvin. However, as Calvin pointed out, the findings he obtained indicated that punishment of the kind used in jumping stand experiments introduces an extraneous factor such as frustration or rigidity which makes evaluation of the actual effect of nondifferential non-reward impossible in this type of experimental situation. In our experiment it was possible to avoid the introduction of such a factor, by using non-reward rather than punishment, and it is this modification in experimental design rather than any phylogenetic change which the present authors feel accounts for the difference between our findings and those of other investigators who used rats for their experimental population.

Before attempting to resolve the discrepancy between those findings which indicate superior performance for groups having nondifferential experience and those experiments which fail to confirm this hypothesis, let us examine for a moment the theoretical positions of Hull and Bitterman which prompted much of the research in this area. Hull's (6) concept of a negatively accelerated growth function for habit strength, of course, leads to the prediction that it is more difficult to establish a differential response between two strong habit patterns than between two weak ones. [For a more detailed derivation see Hull (6, p. 29).] Bitterman has recently

modified his position. He has discarded his original perceptual differentiation hypothesis (2) for a two factor explanation (3) which may be summarized as follows: (*a*) a general tendency for nondifferential reward to retard future differential discrimination due probably to some attentional modification; (*b*) nondifferential reward on the actual stimuli to be discriminated lessens the general tendency for nondifferential reward to retard —either by perceptual differentiation or some other factor which serves to forestall the negative transfer.

At first glance, both Hull's and Bitterman's theoretical positions seem unable to account for our results. Since Bitterman has posited negative transfer from a nondifferential reward situation to a discrimination situation (although this negative transfer is ameliorated somewhat by exposure to the same stimuli to be discriminated), he would not be able to account for the inferior performance of the control *S*s in Group I who had *no* nondifferential experience. It appears that since Hull has postulated a negatively accelerated growth of habit strength, he too would be unable to explain the inferior performance of Group I. However, on closer inspection, we note that during their predifferential training Groups II and III were working on a problem similar to the test problem. Thus positive transfer from the training problem to the test problem may well account for the superior performance of these *S*s. That some such factor is operating receives considerable support when we examine the effect which performance on the preliminary problem has on performance on the test problem. Of the seven *S*s who failed to solve the preliminary problem, four failed to solve the test problem. A breakdown of the 17 *S*s who solved the preliminary problem revealed that only two failed to solve the test problem. (An *S* was considered to have solved the preliminary problem if his last eight choices were correct.) A χ^2 was computed, and, using Yates' correction for continuity, a χ^2 of 4.82 was obtained which is significant beyond the 5 per cent level. When the actual scores on the test problem of those *S*s who failed the preliminary problem are compared by the U test with the test problem scores of those *S*s who solved the preliminary problem, the difference is significant beyond the 1 per cent level. Thus, those *S*s who solved the preliminary problem were significantly superior on the test problem. Since approximately 70 per cent of the *S*s in Groups II and III solved the preliminary problem, it seems reasonable to assume that the superiority of these groups on the test problem was due in a large degree to positive transfer from the preliminary problem.

When viewed in the light of the preceding analysis, it seemed to the authors that it might prove fruitful to analyze previous experiments in nondifferential reward and punishment in terms of negative and positive transfer from the preliminary problem to the test problem. After completing such an analysis, it appears to us that the discrepant findings which seemed to necessitate a number of *ad hoc* assumptions for explanation could be

accounted for by the following postulates relating to transfer: (*a*) In a situation where two stimulus objects receive nondifferential reward or punishment[2] in a context where there is an available solution, this training will result in positive transfer. The amount of positive transfer will be inversely related to the number of possible solutions available in the nondifferential situation (assuming, of course, that the problem has only one actual solution) and will be directly related to the degree to which these possible solutions have been explored. (*b*) In a situation where two stimulus objects receive nondifferential reward or punishment in a context where there is no available solution, this training will result in negative transfer. The amount of negative transfer will be inversely related to the number of possible solutions available in the nondifferential situation (in this case, of course, none of the "solutions" will actually solve the problem) and will be directly related to the degree to which these alternative solutions have been explored.

To simplify matters, we will assume that in the course of nondifferential experience each possible solution has an equal chance of occurring. When this is not the case, of course, then the number of possible solutions cannot be merely added together, but instead each solution must be weighted according to its relative probability of occurrence before they are combined. A situation where the probability of occurrence of the actual solution is very low in comparison to the other alternative solutions will necessitate a great deal of nondifferential experience before significant positive transfer to the new situation will take place, etc.

It also appears likely that the amount of transfer would not prove to be a simple linear function and that it would approach an asymptote relatively unaffected by either the degree of exploration or the number of possible solutions; however, the exact shape of the curve will have to await additional experimental work.

Space will not permit us in the present paper to present our analysis of the previous work in this area utilizing empirical findings to support our theoretical formulation, but it seems apparent that without controlling for the effects of transfer from the nondifferential situation to the test problem an adequate test of such concepts as the growth of ${}_{S}H_{R}$, perceptual differentiation, etc., is not possible.

Experiment II

This experiment was designed to control for the factor of transfer in nondifferential experience; thereby enabling us to obtain a test of Hull's

[2] Punishment here includes both non-rewarded situations and situations in which the *S* is actually punished for making an incorrect response. In the latter case, as Calvin (5) pointed out, it is often impossible to evaluate adequately the effect of nondifferential experience.

and Bitterman's positions which would not be confounded as in previous experiments which did not control for this factor.

Method

The *Ss* were 48 children from the third grade of a local public school. They were randomly divided into three groups of 16 each, the only restriction being that each group consist of eight males and eight females.

The apparatus and procedure were similar to that utilized in Experiment I.

Group I (the Control Group) was presented with a standard simultaneous discrimination problem with the three starred and four starred cards described in Experiment I serving as cues. The three starred card was positive for half the *Ss* and the four starred positive for the other half. Group II (the Same Group) received 20 training trials of white vs. three and four stars. The appearance of the three or four starred card on a given trial was determined according to a modified random order so that each card was presented no more than three times in succession, and each was viewed equally often. For one-half the *Ss* the starred cards were positive and for the other half the white was positive. Upon completion of the training trials *Ss* were given the standard discrimination problem of Group I, i.e., to discriminate between three vs. four stars. Group III (the Different Group) received 20 training trials in the same manner as Group II except that instead of the starred cards they were shown two figured cards—one with a green triangle in the center and the other a green circle. As in the case of Group II the appearance of the triangle or circle card on a given trial was determined according to a modified random order so that each card was presented no more than three times in succession, and each was viewed equally often. For one-half the *Ss* the figured cards were positive and for the other half the white card was positive. Upon completion of the training trials *Ss* in Group III were given the standard discrimination problem of Group I. The criterion for learning was the same as in Experiment I.

Results and Discussion

Since the *Ss* in Group II and III had training on a problem which should lead to equal amounts of transfer in terms of our previous postulates, let us see what Bitterman and Hull would predict in regard to our findings. Bitterman's position, as we noted previously, maintains that there is a general tendency for nondifferential reward to retard future differential discrimination due probably to some attentional modification, and that nondifferential reward on the actual stimuli to be discriminated lessens the general tendency for nondifferential reward to retard—either by perceptual differentiation or some other factor which serves to forestall the negative transfer. Thus he would predict that Group I should perform better than either Groups II or III and further that Group II's performance would

prove superior to Group III.[3] Hull does not deal specifically with comparisons of Group I contrasted with Groups II and III, but he does predict that the performance of Group III should be better than that of Group II. Since there was no difference in performance between those *Ss* receiving nondifferential reward and those receiving nondifferential non-reward, these two groups were combined and the general findings are presented in Table 2. The trials to learn were tested by the U test (all tests were two-tailed). The difference between Group I and Group III was significant beyond the 5 per cent level; the difference between Group I and Group II was significant beyond the 8 per cent level; and the difference between Group II and Group III was not significant. Since none of the predictions made from Bitterman's position were confirmed, it would seem that some radical change in his theory is called for. The performance of Group III was superior to Group II as predicted from Hull's theoretical position; however, this difference was not significant. The authors believe (although this is admittedly *ad hoc*) that this lack of significance can be ascribed to the relative position on the generalization gradient of the test and training stimuli; therefore, we are about to begin an experiment in which the stimuli used are much further apart on the generalization gradient, thereby lessening the effect of stimulus generalization.

TABLE 2

MEDIAN TRIALS TO LEARN

Group	*Trials*	*No. of Ss Who Failed to Solve*
I. Controls	13	5
II. Same	11	3
III. Different	10	0

We believe our findings indicate the necessity of taking the type of preliminary training into account when designing experiments to test such concepts as perceptual differentiation, ${}_{S}H_{R}$, etc. In previous experiments presenting results favorable to Bitterman's theoretical formulation (2, 3), the control animals were presented with two identical grey cards thus cutting down the amount of possible solutions during the training period and, according to our postulates, increasing the relative amount of negative transfer for the controls. When this variable is controlled, as in the present experiment, the results fail to support Bitterman's position.

[3] Bitterman does not specifically deal with the non-reward situation. However, the trends for both the rewarded and non-rewarded *Ss* were the same.

Summary and Conclusions

Two experiments are presented which indicate the importance of the type of preliminary training in evaluating the effect of nondifferential experience. When the amount of possible choices in the nondifferential training is held constant, the results obtained fail to support Bitterman's recent theoretical formulations. Hull's position also is not supported in a statistically significant manner. The implications of these findings are discussed.

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THE DIRECTION OF AGGRESSION IN THE MOTHER-CHILD PUNISHMENT SITUATION [1]

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While punishment has generally been held to be a mechanism by which socialization takes place (3, 4, 7, 9, 12, 13) and has been offered as an explanation or a contributing factor in behavior problems ranging from delinquency (8, 13) to psychosis, the majority of investigations studying this phenomenon have been confined to animal experimentation. The inability and/or lack of feasibility of placing human subjects into a punishment siutation, combined with the lack of available techniques, have doubtless served to hinder research with humans. Several major techniques have been commonly employed to investigate punishment on the human level. Through use of records of the TAT, sentence completion test responses, and attitude questionnaires, Hoffman (5) attempted to relate reactions to parental punishment to compulsive conformity. Sears and his associates (3, 11, 12) made extensive use of doll-play interview and rating scales in their investigations of frustration and punishment.

The purpose of the present study was to investigate the usefulness of a newly-designed projective device—the Punishment Situations Index (PSI)—for assessing punishment in the mother-child relationship. Specifically, we are interested in examining the perception of the direction of aggression in the punishment situation.

THE PUNISHMENT SITUATION INDEX

The Punishment Situation Index consists of two sets of 10 cartoons each, one set for use with girls and another for use with boys. In each picture, a child and his (her) mother are depicted in a situation commonly

[1] This research study was supported by funds made available by the Federal Research Project on Family Life. The writers wish to acknowledge the kind cooperation given by Dr. Clara Tucker, Project Director.

followed by punishment. Card 6 from both series is shown in Figures 1 and 2. In order of presentation, the 10 situations are as follows:

Card I. Situations involving possible physical injury. Male—Boy is shown emerging from a fight with two other boys. Female—Girl is hanging by her knees from a tree.

Card II. Unfavorable relationships with siblings. Male—Boy is teasing his sister while she cries. Female—Girl has taken her little brother's toy away from him.

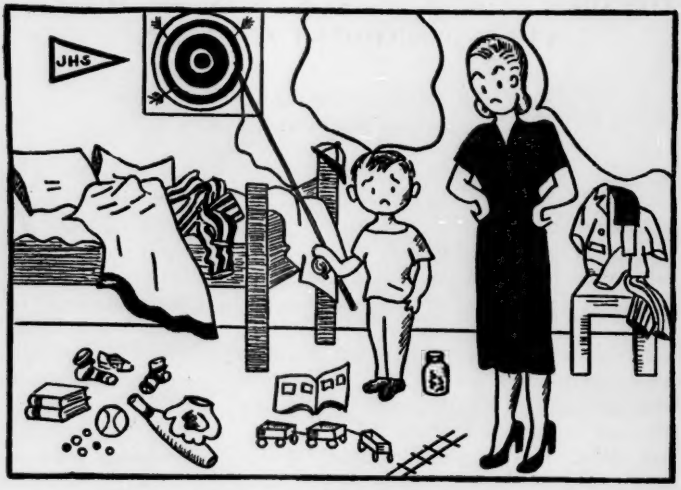

FIGURE 1—Card 6 of the Male Series of the Punishment Situation Index dealing with the lack of neatness in personal habits.

Card III. Socially unacceptable or socially embarrassing behavior. Male—Boy enters the room undressed while the mother is entertaining guests. Female—Girl enters the room undressed while the mother is entertaining guests.

Card IV. Interference by destruction of parents' personal possessions. Male—Boy has broken his mother's vase. Female—Girl dressing up in her mother's clothes and using her make-up.

Card V. Unfavorable intellectual attainment. Male—Boy has brought home a bad report card to his mother. Female—Girl has brought home a bad report card to her mother.

Card VI. Lack of neatness in personal habits. Male—Boy and his mother are shown in his room which is in a state of disorder. Female—Girl and her mother are shown in her room which is surrounded by disorder.

Card VII. Disobedience to parent. Male—Girl telling mother that the boy has disobeyed her by going swimming when told not to. Female—Boy

telling mother that the girl has disobeyed her by going swimming when told not to.

Card VIII. Lying. Male—Girl telling mother that the boy is not telling the truth. Female—Boy telling mother that the girl is not telling the truth.

Card IX. Destruction of other's property. Male—Boy has broken a neighbor's window playing ball. Female—Girl picking a neighbor's flowers.

Card X. Stealing. Male—Girl telling mother that the boy took apples at the store. Female—Boy telling mother that the girl took candy at the store.

FIGURE 2—Card 6 of the Female Series of the Punishment Situation Index dealing with the lack of neatness in personal habits.

Pictorially, the cartoons are designed to be as unambiguous as possible to ensure that the subject will interpret them as having punishment implication. Spaces are provided above the figures as in comic strip cartoons for the subject to fill in what he thinks each character is saying. Because of the nature of the pictures, the PSI can be used with both mothers and children. When administered to both mothers and children, the PSI yields four concepts operating in the punishment situation: from the child, his self-concept (CC) and his concept of his mother (CM); from the mother, her self-concept (MM) and her concept of the child (MC). It was initially hypothesized that each subject, child or parent, would project his own attitudes toward punishment in his responses, and, where appropriate, would identify himself with the child or parent figure.

On the basis of exploratory administrations of the PSI, the following hypotheses are proposed:

I. Mothers are more extrapunitive in the punishment situation than their children, both according to themselves and their children.

II. Children are more intropunitive in the punishment situation than their mothers, both according to themselves and according to their mothers.

III. There is less impunitiveness in the punishment situation in both mother's and children's responses than either extrapunitiveness or intropunitiveness.

Scoring

Because of the similarity in design of the PSI to the *Rosenzweig Picture-Frustration* cards, the obtained responses were scored using the three scoring factors, Extrapunitiveness, Intropunitiveness and Impunitiveness for *direction of aggression,* developed by Rosenzweig (9, 10). Examples of the scoring of PSI responses are given below:

Extrapunitiveness (E): Aggression is directed onto some person or thing in the environment. Typical of responses here are: (Child:) My mother didn't know what she was talking about. I felt mad at her. (Mother:) Will you *ever* learn to behave? You're a naughty little girl.

Intropunitiveness (I): Aggression is directed by the subject onto himself. Typical of responses here are: (Child:) I shouldn't have done it. I need to be punished.

Impunitiveness (M): Aggression is evaded in an attempt to gloss over the punishment. Typical of responses here are: (Mother:) That's just like a little girl. (Child:) I forgot it, I didn't even think of it anymore.

Combinations of any *two* of these three directions may occur within any one response. When two distinct thoughts were expressed, each response was counted as one-half point in the scoring scheme.

Subjects and Procedure

Subjects for the present study were 24 fourth, fifth, and sixth grade children and their mothers. These children, made available for testing by the Highland Elementary School,[2] in Baton Rouge, Louisiana, ranged in age from 9 to 12 with a mean age for the group of 10.26. This age group was selected rather than a younger group because of their greater facility in speech and reading. The sample consisted of 14 girls and 10 boys, most of whom came from homes of professional fathers.

The Inquiry: Child

An inquiry was individually conducted in conjunction with each of the 10 pictures presented to the subject. The format of the inquiry for the child was as follows:

[2] The writers wish to express appreciation to Miss Geraldine Wall, Principal, for her helpful cooperation in making subjects available for this study.

Interviewer: "I am going to show you some pictures of a little boy (girl) and his (her) mother. In each picture, each boy (girl) is doing something different. I would like you to answer some questions about what they are doing."

The subject was then presented with a card, and the inquiry proceeded as follows:

Q-1. Tell me what is happening in this picture.
Q-2. Pretend you are the little boy (or girl) in this picture. Tell me what your mother would say if this happened. (CM)
Q-3. What would you say to your mother? (CC)
Q-4. What would your mother do if this happened? (CM)
Q-5. What would you do if this happened? (CC)
Q-6. How would you feel when your mother did that? (CC)
Q-7. How do you think your mother would feel when she did that? (CM)

The Inquiry: Mother

The interviewer explained to the mother at the outset of the session: "In the attempt to arrive at a better understanding of the relationships between mothers and their children, we are currently investigating the ways in which parents teach their children things such as honesty, obedience, and so forth." [3]

Since the mother might refer to a child other than the subject selected for the study, the interviewer was instructed always to make sure he knew which child the subject was referring to, especially when she referred to him by name.

In the case of mothers who had two children of the same sex and approximately the same age, the interviewer instructed the parent that she was to consider her answers in terms of the one child only. To ensure that the subject did this, the interviewer asked the mother to mention the name of her child in each question where the word *child* appeared. The following instructions were then given: "We have some pictures of children and their mother in typical situations that most parents have to deal with at some time. I would like you to answer some questions about what they are doing in the pictures."

Q-1. What do you think has happened in this picture?
Q-2. What do you think you would say if this were your child? (MM)
Q-3. What do you think your child would say? (MC)
Q-4. What would you do if it happened? (MM)
Q-5. What would your child do if it happened? (MC)
Q-6. How do you think he would feel when you did that? (MC)
Q-7. How would you feel at the time you did that? (MM)

[3] It was obviously anticipated that the mothers would exhibit greater curiosity than the children as to the purpose of the study. The preliminary explanation to the mothers was used to establish rapport. Since the actual purpose was not revealed to either the mothers or the children, it is felt that the instructions did not differentially affect their responses.

Results and Discussion

Each of the inquiries was scored according to the method developed by Rosenzweig (2, 9, 10). Responses to Questions 2, 4, and 7 of the children's inquiry were concerned with the child's concept of his mother (CM), and Questions 3, 5, and 6 dealt with the child's concept of himself (CC). Questions 3, 5, and 6 of the mother's inquiry dealt with the mother's concept of the child (MC), and Questions 2, 4, and 7 of this inquiry were concerned with the mother's self-concept (MM). The mean number of times each method of direction of aggression was employed by either the child or the mother will be considered here in relation to testing each hypothesis outlined.

Table 1

COMPARISON OF DIFFERENCES IN EXTRAPUNITIVENESS (E) ATTRIBUTED TO MOTHERS AND CHILDREN

Variables 1		2		$Mean_1$	$Mean_2$	t
CM_E	>	MC_E	.....	22.00	8.77	12.88*
MM_E	>	CC_E	.....	17.42	7.90	8.21*
MM_E	>	MC_E	.....	17.42	8.77	8.32*
CM_E	>	CC_E	.....	22.00	7.90	12.21*
CM_E	>	MM_E	.....	22.00	17.42	3.98*
MC_E	>	CC_E	.....	8.77	7.90	.83

* Significant beyond the .01 level.

Hypothesis 1

According to this hypothesis, in the punishment situation mothers are more extrapunitive than their children, both according to themselves and their children. If this relationship is found to hold, we would predict that $CM_E > MC_E$, $MM_E > CC_E$, $MM_E > MC_E$, and $CM_E > CC_E$. To test this relationship, t tests for matched groups on extrapunitiveness scores were computed. As shown in Table 1, the differences were not only in the expected direction, but in every case, were significant beyond the 1 per cent level. These findings indicated that the mothers tend to project blame onto another person and/or the environment from both their own and their children's points of view.

From the means contained in Table 1, it appears that the children's concept of the mother's extrapunitiveness is considerably greater than the mother's concept of her own outward aggression, and likewise, the mother's conception of the children's aggression greater than the child's self-concept. These subhypotheses were tested using a t test of significance. The theory

that children conceive of mothers as more extrapunitive than mothers conceive themselves to be was clearly sustained, and is in line with the psychoanalytic contention that the parent figure is regarded as threatening by the child. The idea that the mother has a greater conception of the child's extrapunitiveness, however, was rejected.

Hypothesis II

According to the second hypothesis, children are more intropunitive in the punishment situation than their mothers, both according to themselves and their mothers. For this hypothesis to be sustained, it is necessary for the following relationship to hold: $MC_I > CM_I$, $CC_I > MM_I$, $MC_I > MM_I$, and $CC_I > CM_I$. The results of the *t* tests applied here are shown in

TABLE 2

COMPARISON OF DIFFERENCES IN INTROPUNITIVENESS (I) ATTRIBUTED TO MOTHERS AND CHILDREN

Variables 1		2		*Mean*$_1$	*Mean*$_2$	*t*
CM_I	<	MC_I	.....	1.52	10.17	11.98*
MM_I	<	CC_I	.....	5.71	10.08	3.83*
MM_I	<	MC_I	.....	5.71	10.17	5.41*
CM_I	<	CC_I	.....	1.52	10.08	8.02*
CM_I	<	MM_I	.....	1.52	5.71	7.16*
MC_I	>	CC_I	.....	10.17	10.08	.07

* Significant beyond the .01 level.

Table 2. In all cases, significance exceeded the 1 per cent level, leading to the conclusion that children are more intropunitive than their mothers both according to themselves and their mothers.

Inspection of the mean frequencies also indicated the relationship: $MM_I > CM_I$, and $CC_I > MC_I$. That mothers conceive of themselves as more intropunitive than children conceive them to be was clearly indicated by the *t* test; that children conceive of themselves as more intropunitive than mothers conceive them to be, however, failed to meet significance.

As in the case for the extrapunitive expression of aggression, we can conclude that the mother's concept of the child is in close agreement with the child's concept of his intropunitiveness. This finding confirms the view suggested above: that children regard the parent-figure as threatening, and as a result, tend to overestimate the mother as a punishing agent (extrapunitiveness), and underestimate her as intropunitive. That is, children believe that the mother does not often take the blame herself for incidents which occur, but rather tends to blame them.

Hypothesis III

In line with our third hypothesis, we were interested in determining whether impunitiveness occurs less frequently in punishment situations than either extrapunitiveness or intropunitiveness. If this is to be sustained, then all measures of E and I for both the mothers and children must be greater than all measures of M. Since the frequency of M responses was too small to give a normal distribution, the sign test was here employed (see Table 3). This third hypothesis was shown to hold at the 1 per cent level in all but two cases: $CC_I - CC_M$ was found significant at the 5 per cent level; $CC_E - CC_M$ was found nonsignificant.

TABLE 3

RESULTS OF SIGN TEST COMPARING EXTRAPUNITIVENESS, INTROPUNITIVENESS, AND IMPUNITIVENESS ATTRIBUTED TO MOTHERS AND CHILDREN

Variables	*N**	*r*†	*Level of Significance*
$CM_E > CM_M$	24	0	.01
$MM_M > MM_M$	24	0	.01
$MC_E > MC_M$	22	3	.01
$CC_E > CC_M$	24	8	.25
$CM_I > CM_M$	20	3	.01
$MM_I > MM_M$	22	3	.01
$MC_I > MC_M$	24	1	.01
$CC_I > CC_M$	21	5	.05

* *N* is the number of persons in the sample, ignoring all pairs with a difference of zero.
† *r* is the smaller of two values.

It also appeared that more impunitiveness was attributed to children than to the mother group; that is, the following relationship should be sustained: $MC_M > CM_M$, $CC_M > MM_M$, $MC_M > MM_M$, and $CC_M > CM_M$. The application of the sign test again sustained these relationships (Table 4) at beyond the .01 level of confidence, supporting the hypothesis that children are more impunitive than mothers, both according to themselves and according to their mothers. From these findings, it appears that children in the punishment situation tend to blame themselves more than mothers. Children also appear to evade or gloss over frustration more than their mothers. As a result, mothers direct more blame and hostility onto the children than the children direct towards their mothers. And children appear to overestimate the amount of blame directed towards them in comparison with what their mothers believe they do. In line with their overestimation of mother's extrapunitiveness, children also underestimate

the amount of blame mother's take themselves as compared to what mothers believe they do.

TABLE 4

COMPARISON OF DIFFERENCES IN IMPUNITIVENESS (M) ATTRIBUTED TO MOTHERS AND CHILDREN

Variables	*N*	*r*	*Level of Significance*
$MC_M > CM_M$	23	0	.01
$CC_M > MM_M$	23	4	.01
$MC_M > MM_M$	21	0	.01
$CC_M > CM_M$	22	0	.01

SUMMARY AND CONCLUSIONS

The development of a new projective test—the *Picture Situations Index*—was undertaken in an attempt to investigate and assess the direction of aggression in the mother-child punishment situation. Two sets of 10 cards each, one for boys and one for girls, were designed to depict common situations often leading to punishment. This test was administered to 24 school children between the ages of 9 and 12, and their mothers. The inquiry for each card, a rather structured cartoon-like sketch, was designed to yield four concepts usually operative in the punishment situation: the child's concept of the mother (CM); the child's self-concept (CC); the mother's concept of the child (MC); and the mother's self-concept (MM).

Three measures of the direction of aggression, Extrapunitiveness, Intropunitiveness, and Impunitiveness, were utilized in the data analysis. On the basis of the emerging concepts of the mother and child obtained through this scoring method, the following conclusions appear warranted: (*a*) Mothers direct more aggression onto their children than children direct onto mothers. (*b*) Children conceive of mothers as directing more aggression onto them than mothers conceive of themselves as doing. (*c*) Children direct more of their aggression onto themselves than mothers direct onto themselves. (*d*) Mothers conceive of themselves as directing more aggression onto themselves than children conceive of them as doing. (*e*) Children are more likely than mothers to gloss over and evade punishment.

The major conclusion warranted from the present results is that the merit of the PSI for studying the mother-child situation through the use of "concepts" lies not in the "validity" of the responses as such, but in the finding that mother and child view it from a different frame of reference, as evidenced in the discrepancies of their responses to the same objective stimulus card. The discrepancies between self-perception and

others' perception of the self could result in the difference between mutual understanding and perceived rejection leading to possible punishment, unwarranted or otherwise. If we can assume that both child and mother reveal significant aspects of personality in their responses, the PSI might provide the much needed "bridge" between punishment and personality which hithertofore has been dismissed by reasoning of the type: this child is delinquent, he was severely punished, ergo, he is delinquent because he was severely punished. Such a technique as has been described here might direct light on some of the more obscure aspects of the punishment situation.

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CALCIFICATION OF THE MANDIBULAR THIRD MOLAR AND ITS RELATION TO SKELETAL AND CHRONOLOGICAL AGE IN CHILDREN[1]

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Whereas theoretically it may be expected that an intimate relationship exists in the physical maturation of various tissue systems and that this relationship is reflected by the different maturity indicators, the correlation between dental development and growth of the body as a whole is claimed to be low (1, 8).

Yet Talmers (9) has demonstrated that children with late emergence of permanent teeth were usually delayed in both height and weight gain when appraised by referring to the Fels norms, and that children with early eruption of teeth were advanced in their physical growth. The asso-

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ciation between these three variables was demonstrated most clearly for children with late eruption of teeth.

Gleiser and Hunt (2, 4) studied the chronology of calcification of the permanent mandibular first molar in considerable detail and reported that arrests in the ossification of hand and wrist bones often coincide with arrests in tooth formation.

The present study deals with the calcification of the mandibular third molar since it is desirable, especially for the orthodontist, to have this information for evaluating dental development between 9 and 15 years of age, or after the permanent mandibular first molar can be used for this purpose. Such data can complement the estimate of dental maturation based on the clinical emergence of permanent teeth, and Gleiser and Hunt (2) suggest "that the calcification of a tooth may be a more meaningful indication of somatic maturation than is its clinical emergence." The relationships between third molar development and chronological and skeletal age were studied also.

The Present Study

A total of 151 American white children of Greater Boston, who were patients at the Forsyth Dental Infirmary for Children and without obvious signs of nondental disease or of developmental disturbances, were selected for examination according to the year of birth (Fig. 1). When, however, the 81 boys and 70 girls are grouped according to age (Fig. 2), the resulting frequency distributions differ considerably from those based on the year of birth, due to the time lapse between the examination of the first and last subject. In each instance, almost invariably on the same visit, radiographs of the right hand and wrist as well as of the jaw were taken.

The hand radiographs were analyzed according to the technique of S. Idell Pyle by computing the mean skeletal age after comparing each bone of the hand and wrist to the standards of Greulich and Pyle (3). Since in this study only one evaluation of skeletal age was needed, rather than a longitudinal picture of skeletal development, no consideration was given to the differences in maturation of the various hand bones of the individual child, as required by the "Red Graph" method (6).

Differences in evaluating skeletal age were determined by independent examinations of the hand radiographs of 30 children (15 boys and 15 girls). The results, summarized in Table 1, show a high degree of similarity between the readings made by the two observers.

For the evaluation of the calcification of the mandibular third molars, use was made of the standards developed by Gleiser and Hunt for the first molar. Yet, independently of the authors just mentioned, an attempt was made in the initial stage of this study to find suitable developmental stages

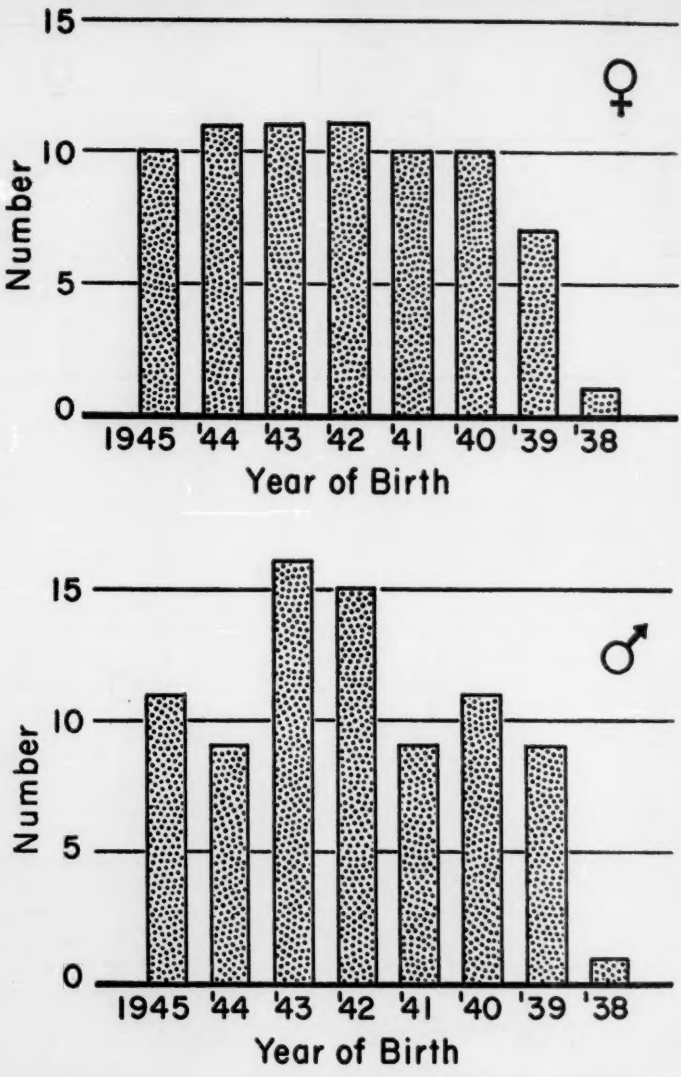

FIGURE 1—The frequency distributions according to the year of birth of the 70 girls and 81 boys studied.

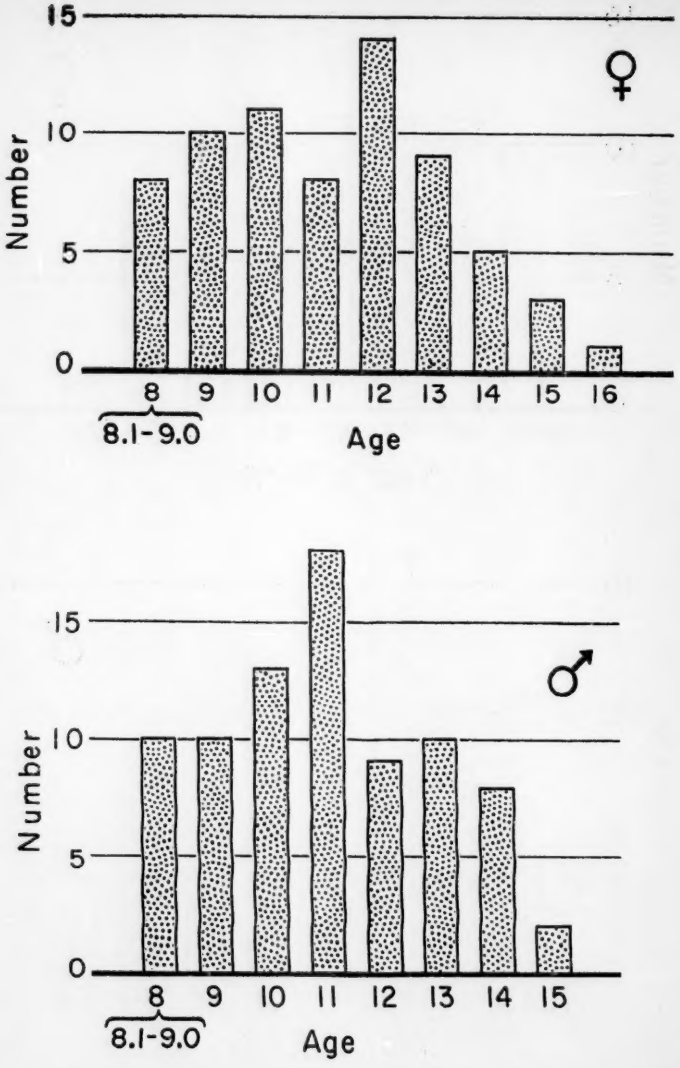

FIGURE 2—The frequency distributions according to the chronological age of the 70 girls and 81 boys studied.

TABLE 1

DIFFERENCES BETWEEN INDEPENDENT EVALUATIONS OF A SERIES OF 30 HAND RADIOGRAPHS BY TWO OBSERVERS

Rating D > *Rating W*			*Rating D* = *Rating W*	*Rating D* < *Rating W*		
9 mo.	6 mo.	3 mo.		3 mo.	6 mo.	9 mo.
0	2	2	22	1	3	0

for gauging the calcification of the third molar. This resulted in almost the same scale as that of Gleiser and Hunt, except that stage 6—2/3 of crown completed—could not be differentiated accurately from its neighboring stages and it was, therefore, omitted. Stage 6 in the present study, signifying completion of the crown, thus corresponds to stage 7 of Gleiser and Hunt and stage 7, the beginning of root formation, to their stage 8. The upper age limit of the sample was not high enough to study the subsequent stages of root formation until the terminal convergence of the root canal. The definitions of each calcification stage as used in this study are given in Table 2.

Unfortunately, it was not possible to obtain satisfactory roentgenologic records for classifying the development of the maxillary third molars, which explains why this investigation was limited to studying the mandibular molars.

Differences in assessing mandibular third molar development were determined by independent evaluations of 50 lateral jaw radiographs. Since

TABLE 2

DEFINITIONS OF EACH STAGE OF THIRD MOLAR CALCIFICATION USED IN THIS STUDY

0	No change in bone density, and no crypt visible.
1	Crypt clearly visible, but no calcification.
2	Calcification of the tips of one to four cusps.
3	Coalescence of two or more centers.
4	Outline of the cusps completed, calcification progressing towards the level of the grooves, but the center of the occlusal crown surface may not yet be calcified.
5	Half of the crown completed, calcification up to the largest mesiodistal diameter of the tooth crown, but the entire enamel formation not yet completed.
6	Crown completed, enamel formation completed to enamel-cementum junction.
7	Beginning of root formation.

stage 5 offered the greatest difficulties for proper classification, a larger number of teeth in this stage than in the other stages of development was selected by the first examiner to test whether his co-observer agreed with the rating given. The disagreement in evaluations of third molar development was never more than one stage, and the range of identical ratings varied between 60 and 100 per cent, as shown in Table 3.

TABLE 3

DIFFERENCES BETWEEN INDEPENDENT EVALUATIONS OF 50 RADIOGRAPHS OF THE MANDIBULAR THIRD MOLAR BY TWO OBSERVERS

	STAGE OF CALCIFICATION								
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*Total*
Number of radiographs	5	6	4	5	6	14	5	5	50
Rating D = Rating W	5	4	4	5	4	10	3	4	39
Rating D ≠ Rating W	0	2	0	0	2	4	2	1	11
Per cent of identical ratings ...	100	67	100	100	67	71	60	80	78

The reliability of evaluations of both the wrist and lateral jaw radiographs is considered adequate in view of the following reasons: (1) In general, no tendency for consistent over- or underrating by one observer compared to the other was observed. (2) In testing for the differences when two observers independently studied a series of hand radiographs, the same mean bone age was found in 73 per cent of trials, and, when testing the evaluations of molar calcification, identical ratings were obtained in 78 per cent of the double determinations. The number of identical ratings is thus similar in both instances.

Differences in evaluating third molar development do not exceed one stage or one-sixth of the entire scale of crown formation. The differences in the estimate of bone age are no greater than 6 months which corresponds, according to Gleiser and Hunt, to about one-seventh of the time needed for the formation of the crown of the first molar. If it is assumed, for practical purposes, that the speed of formation of the mandibular third molar crown is approximately the same as that of the first molar, the differences in independent evaluations of molar development and bone age do not exceed one-sixth of the time needed for completion of the third molar crown, or 7 months in the boys and 9.7 months in the girls. However, for bone age only the maximal differences amount to 6 months, while for molar calcification the differences can never be less than one stage. Therefore, the errors made by the two observers in studying third molar development are often greater than those made by them when assessing skeletal age.

Findings

The findings can be grouped under four headings, namely: (1) the relationship between skeletal age and chronological age, (2) degrees of bilateralism in the development of left and right third molars in the mandible, (3) the median chronological and skeletal ages for each calcification stage of these third molars, (4) the mutual relationships between third molar calcification and skeletal and chronological age.

1. The mean difference between skeletal age and chronological age is zero months in the 81 boys and 6 months in 70 girls studied (Table 4). Thus in the average girl the skeletal age is one-half year advanced compared to the chronological age. The range of approximately 48 months for both sexes corresponds closely to the findings of Greulich and Pyle. In a group of "normal" early and late maturing children one may, therefore, expect differences as great as 24 months between the two measures of development.

Table 4

THE MEAN DIFFERENCE AND STANDARD DEVIATION OF SKELETAL AGE AND CHRONOLOGICAL AGE

	N	*Mean*	*S.D.*
Boys	81	0 months	± 12.3 mo.
Girls	70	6 months	± 10.1 mo.

2. Chronological symmetry in the development of the mandibular left and right third molars occurs in 71 per cent of the boys and girls. In the others differences of one, but not more than two, developmental stages are observed in the calcification of antimeres. It is not possible to conclude from the data at hand whether a definite trend exists for more advanced development on one side of the mouth than on the other.

Saito (7) reported earlier calcification and eruption of third molars on the right side of the mouth when compared with those on the left, and he also found that Japanese girls had a more rapid developmental rate than Japanese boys until the age of 13 years. This last conclusion is not corroborated by the findings of the present study.

Unilateral agenesis must be considered also as an asymmetry of development. However, great care was necessary in diagnosing agenesis in this group of young Bostonians inasmuch as the beginning of calcification, as manifested in radiographs (stage 1), was observed as late as 12 years and 5 months in some children.

TABLE 5

AGENESIS OF MANDIBULAR THIRD MOLARS IN CHILDREN "AGED 13.1 YEARS AND OLDER"

	N	*Unilateral*	*Bilateral*	%
Boys	21	1	1	9.5
Girls	17	2	4	35.3

In the small sample of boys 13 years 1 month and older (Table 5), the combined frequency of unilateral and bilateral mandibular third molar agenesis was 9.5 per cent and in the still smaller group of girls it was as high as 35.3 per cent. After an analysis of extensive radiographic material Saito (7) reported "congenitally missing" mandibular third molars in 20 per cent of his Japanese sample, while Nanda (5) found agenesis of one

TABLE 6

MEDIAN CHRONOLOGICAL AND SKELETAL AGES AS WELL AS AGE RANGES OF THE DIFFERENT STAGES OF MANDIBULAR THIRD MOLAR CALCIFICATION

		Median		Range	
M_3	*N*	*CA*	*SA*	*CA*	*SA*
		BOYS	(*N* = 69)		
1	8	9.2	9.3	8.5 –12.0	8.0 –11.0
2	6	10.3	10.6	9.6 –11.5	9.0 –11.6
3	16	11.1	10.6	8.9 –13.0	8.0 –12.0
4	12	11.7	11.9	10.4 –13.7	10.0 –13.0
5	9	12.11	13.3	10.5 –13.9	11.6 –14.0
6	7	14.0	14.0	10.9 –15.2	12.0 –16.2
7	11	14.7	15.0	12.11–16.1	14.0 –17.0
		GIRLS	(*N* = 51)		
1	5	9.3	9.0	8.6 –12.5	7.6 –11.6
2	3	10.3	10.0	9.9 –11.4	8.0 –12.0
3	9	10.5	11.0	9.0 –14.9	9.0 –13.0
4	13	11.5	11.6	8.11–12.11	9.0 –13.0
5	9	13.6	14.0	11.11–14.6	12.0 –14.2
6	3	12.9	13.0	11.10–12.10	10.0 –13.6
7	9	14.11	15.0	12.4 –15.4	13.6 –16.6

NOTE.—Units in years, fractions in months, CA = chronological age, SA = skeletal age, M_3 (1) = stage of calcification.

or more third molars—maxillary or mandibular—in 9 per cent of 216 North American white women.

Unilateral agenesis of the mandibular third molars did not change the statistical findings concerning symmetry of development because it occurred in only three instances.

3. The median age and the age ranges of each of the seven calcification stages studied are given in Table 6. For these statistics an average calcification rating was used in the case of asymmetric development of antimeres, except that when in an individual one mandibular third molar was rated as being in stage 0, the higher rating of its antimere was used as the overall rating. In the majority of subjects (71 per cent of the total sample), however, the calcification of the left and right third molars was symmetrical, as pointed out already.

In both sexes the median chronological and skeletal ages of third molar stages agree closely, the maximum difference being 7 months for stage 3 in both the males and females.

The numbers of mandibular third molars in each calcification stage in each sex and in the two sexes combined are presented in Table 7, together with the percentage frequencies of teeth in each stage.

TABLE 7

THE NUMBER OF BOYS AND GIRLS WITH MANDIBULAR THIRD MOLARS IN DIFFERENT STAGES OF CALCIFICATION AND THE PERCENTAGE FREQUENCIES OF THIRD MOLARS IN EACH STAGE

(Total number of children = 151, total number of teeth = 302; agenesis not considered)

	STAGE OF CALCIFICATION							
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Boys	33	14	6	28	25	17	14	25
Girls	46	5	4	17	24	19	6	19
Boys + Girls	79	19	10	45	49	36	20	44
Per cent of all teeth	26	6	3	15	16	12	7	15

4. An important aspect of this investigation was to determine whether individuals with early or late skeletal age have a correspondingly advanced or delayed developmental pattern of their mandibular third molars. This relationship could be studied in 69 boys and 51 girls only since in some subjects the first sign of calcification of the mandibular third molars was not seen on the radiographs.

Scatter diagrams were prepared for preliminary analysis of the correlation between the different variables, an average calcification rating being used in case of asymmetric development of mandibular left and right third

molars. Frequency distributions of the observations are given on the *X* and *Y* axes of each scattergram.

After studying the scattergrams (Figs. 3 and 4) it was concluded that the regression lines follow a straight trend. However, when the median chronological and skeletal ages for each developmental stage are plotted on the scattergrams, the points are not found to be on a straight line; but their arrangement is such that it seems justified to assume a straight line trend. Therefore, Pearson's product-moment correlation formula was considered satisfactory for further statistical treatment of the material.

For computations of the correlation coefficients fractions of class intervals of molar calcification, resulting from averaging the findings for left and right third molars, were reduced to full stages (e.g., a rating of 3.5 was included in the stage 3 group).

According to the findings (Table 8), a high degree of association exists between third molar calcification and skeletal or chronological

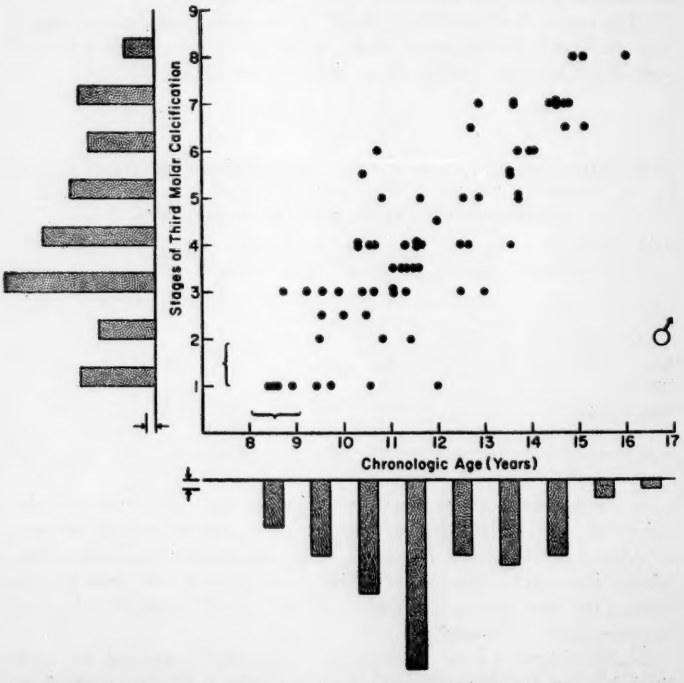

FIGURE 3a—Scattergram to demonstrate the degree of association between stages of third molar calcification and chronological age for 69 boys.

TABLE 8

COEFFICIENTS OF CORRELATION (r) AND THE STANDARD ERRORS ($S.E._r$) OF MANDIBULAR THIRD MOLAR CALCIFICATION (M_3), CHRONOLOGICAL AGE (CA) AND SKELETAL AGE (SA), AND THE MULTIPLE CORRELATION COEFFICIENTS ($R \pm S.E._R$) BETWEEN THESE THREE VARIABLES

	Boys $N = 69$	*Girls* $N = 51$	*Boys and Girls* $N = 120$
	r $S.E._r$	r $S.E._r$	r $S.E._r$
M_3 : CA	.83 ± .037	.73 ± .064	.79 ± .034
M_3 : SA	.86 ± .031	.75 ± .060	.83 ± .028
CA : SA	.89 ± .024	.92 ± .021	.90 ± .016
	R $S.E._R$	R $S.E._R$	R $S.E._R$
SA : CA M_3	.92 ± .019	.93 ± .019	.92 ± .014

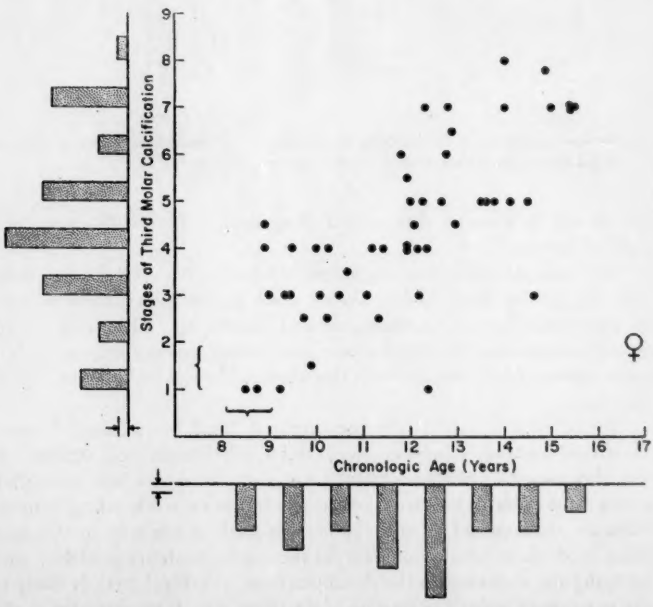

FIGURE 3b—Scattergram to demonstrate the degree of association between stages of third molar calcification and chronological age for 51 girls.

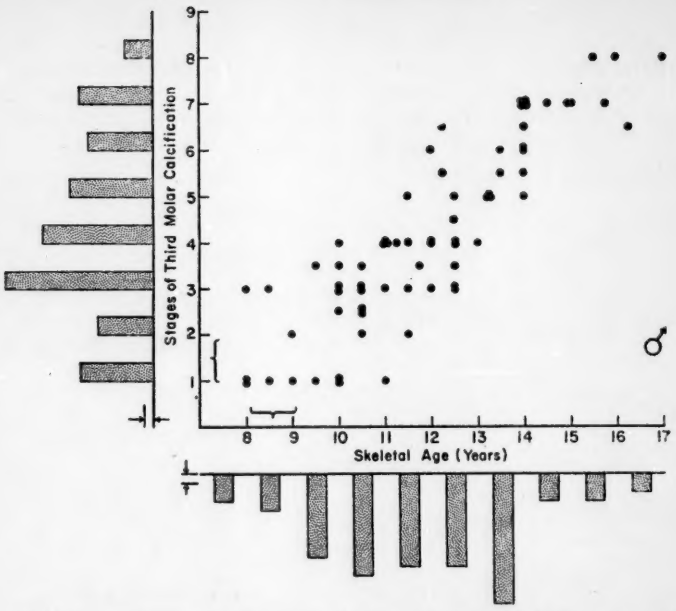

FIGURE 4a—Scattergram to demonstrate the degree of association between stages of third molar calcification and skeletal age for 69 boys.

age as well as between skeletal and chronological age (with values of r ranging between $+.73$ and $+.92$).

The multiple correlation coefficient is likewise high ($R_{SA.CAM_3}$ being $+.92$ or $.93$), but these findings do not differ greatly from those measuring the association between chronological and skeletal age. Therefore, the additional information on third molar calcification enables only a slightly better estimate of skeletal age than that obtained by the use of chronological age alone.

Nevertheless, in view of the comparatively small but significant partial correlation coefficients between third molar calcification and skeletal age with chronological age held constant ($r_{MSA.CA} = +.45$ for boys and girls), it may be possible to estimate skeletal age indirectly when taking into account the development of other permanent teeth in addition to the third molar if adequate calcification data for these other teeth are available, since averaging the variations in the development of individual teeth is likely to give one a more realistic evaluation of the dental age. If the variation in the calcification of different teeth is extensive, it may turn out that a reliable

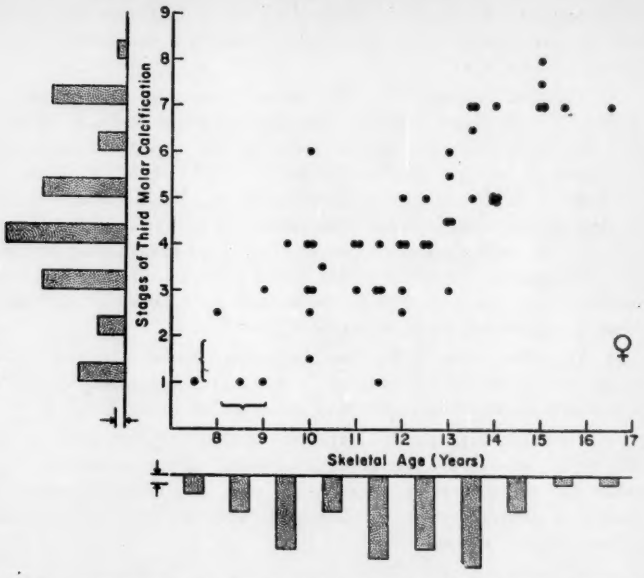

FIGURE 4b—Scattergram to demonstrate the degree of association between stages of third molar calcification and skeletal age for 51 girls.

estimate of skeletal age cannot be made and in such instances it would be of interest to find out from the actual assessment of bone age, by means of the Red Graph, whether the development of the hand and wrist bones also shows a wide distribution around the mean skeletal age. In addition, such efforts would show whether third molar calcification is more variable in comparison to that of other permanent mandibular teeth.

As a pilot study the data presented support the basic theoretical contention that a relationship exists in the physical maturation of various tissue systems, and the chronology of dental development may prove to be useful as an indicator of physiologic age. Exactly how valuable it is for this purpose remains to be established, preferably by a study of longitudinal data on a sufficiently large group of individuals.

SUMMARY

1. Radiographs of the right hand and each half of the jaws of 151 North American white individuals aged 8 to 16 years were studied for assessment of skeletal age and for the development of the mandibular third molars.

For estimating skeletal age, the standards of Greulich and Pyle were utilized and for molar calcification, the (slightly modified) standards of Gleiser and Hunt were used.

2. The results confirm the earlier studies concerning the wide range of skeletal ages compared with the chronologic ages in "normal" children. The differences when two observers evaluate the same wrist radiographs independently are much smaller than the "normal" variation of skeletal age in "healthy" children at a given chronological age. The differences in independent ratings of third molar development are somewhat higher but still adequate for the purpose of this study. Gleiser and Hunt's scale for rating the calcification of mandibular molar crowns appears satisfactory for clinical studies, except that their stage 6, which could not be differentiated clearly from its neighboring stages, had to be omitted.

3. The calcification of the mandibular third molar is symmetrical in 71 per cent of the children studied. In the others, no tendency is seen for consistently advanced development of either the left or right teeth.

4. There is a high positive correlation, with an approximately straight line trend, between the degree of calcification of the mandibular third molar and the skeletal or chronological ages. The findings support the theoretical contention that a relationship exists between the maturation of various tissue systems.

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